ASSESSMENT MANUAL
FOR ACADEMIC PROGRAMS

Guidelines and Procedures

Fahad Bin Sultan University

2024-2025

FAHAD BIN SULTAN UNIVERSITY

DEANSHIP OF QUALITY ASSURANCE
AND ACADEMIC ACCREDITATION

Foreword

Fahad Bin Sultan University (FBSU), located in Tabuk, Kingdom of Saudi Arabia, is a leading private higher education institution committed to academic excellence and innovation. As the first private university in the Kingdom to adopt English as the primary medium of instruction, FBSU demonstrates its dedication to preparing students for global competitiveness and fostering a dynamic, research-driven

Learning environment.

FBSU offers a diverse range of academic programs across its colleges, including the College of Engineering, College of Computing, College of Business and Administration, College of Humanities and Social Sciences, and College of Medicine. These programs, available at both undergraduate and graduate levels, are designed to equip students with the knowledge, skills, and ethical values necessary to excel in their chosen fields and contribute meaningfully to society. With a strong emphasis on science, technology, business, humanities, and healthcare, FBSU provides a comprehensive educational experience that meets the evolving demands of the global workforce.

This **Assessment Manual for Academic Programs** serves as a comprehensive guide to ensure the continuous improvement and quality assurance of FBSU's academic offerings. By aligning with international best practices and accreditation standards, the manual provides a structured framework for program assessment, student learning outcomes evaluation, and curriculum enhancement. It reflects FBSU's commitment to maintaining rigorous academic standards while fostering innovation and adaptability in response to evolving educational and industry demands.

We extend our gratitude to the faculty, administrators, and assessment committees whose expertise and dedication have shaped this manual. It is our hope that this document will serve as a valuable resource in advancing FBSU's mission of delivering high-quality education, promoting student success, and contributing to the Kingdom's Vision 2030 goals.

Message from the Dean of Quality and Academic Accreditation

It is with great pleasure that I present this Assessment Manual for the College of Engineering at Fahad Bin Sultan University. This manual represents our commitment to educational excellence and continuous improvement in line with international standards. Assessment is at the heart of our quality assurance system. It provides us with the evidence we need to evaluate the effectiveness of our educational programs and make informed decisions about improvements. This manual offers a comprehensive framework for assessing student learning outcomes at the course and program levels, with a particular focus on alignment with NCAAA accreditation criteria.

"The NCAAA has identified broad categories or types of learning outcomes in [three groups or learning domains namely knowledge & understanding, skills, and values,] and has described in general terms the level of knowledge and skill expected for different qualifications. There are differences in how these learning outcomes are developed by students, and an important aspect of program and course planning is to plan for teaching processes and forms of assessment that will be appropriate for these different types of intended learning outcomes." (Glossary, NCAAA Handbook)

The manual is designed to be a practical resource for faculty members, providing clear guidelines, templates, and examples for implementing effective assessment practices. It reflects our belief that assessment should be meaningful, manageable, and sustainable, serving as a tool for enhancing student learning rather than merely a compliance exercise.

A key milestone in our assessment journey has been the development of the **Academic Program Assessment Portal** by the College of Engineering. This comprehensive, university-wide system:

- Streamlines assessment processes for all FBSU academic programs
- Facilitates real-time data collection, analysis, and reporting
- Evolves continuously through feedback from faculty and administrators

I encourage all faculty members to familiarize themselves with the contents of this manual and to actively participate in the assessment process. By working together to implement these assessment practices, we can ensure that our engineering programs continue to meet the highest standards of quality and prepare our graduates for successful professional careers.

Thank you for your commitment to educational excellence at FBSU.

Table of Content

List of Figures

List of Tables

Section I

Introduction

Introduction

Student learning assessment is central to FBSU's commitment to continuous improvement and strategic goals for enhancing academic quality. Assessment occurs at institutional, program, and course levels to ensure alignment with FBSU's mission and learning outcomes.

The NCAAA categorizes learning outcomes into three domains: **knowledge, skills, and values**, with defined expectations for each qualification level. Effective program and course design must align teaching methods and assessments with these outcomes.

As part of evidence-based quality assurance, FBSU maintains documented assessment practices in compliance with national and accreditation standards. The university's **Program Assessment Policy** (see appendices) ensures rigorous, transparent evaluation of learning outcomes, reinforcing the credibility of FBSU degrees. This policy promotes effective student learning and assures stakeholders that FBSU degrees are awarded based on valid and reliable assessment methods

This document outlines FBSU's assessment framework, offering guidelines for planning, development, and implementation. Additional resources are provided in the appendices.

1. FBSU's Mission Statement

"FBSU is committed to providing high quality education and fostering scientific research, creativity, ethical conduct, integrity, life-long learning and community engagement."

Fahad Bin Sultan University (FBSU) aims to provide quality education to the highest international standards. In its efforts towards successful and responsible life-long learning, FBSU integrates modern technology, pedagogy, and human values for the advancement of scientific research, productivity, and leadership towards a more meaningful social life.

FBSU is committed to the effective management of institutional resources to optimize its multiple roles as a catalyst for new learning opportunities, national and international partnerships, continuous studies, professional growth, community service, and diversity in educational horizons for the good of humanity.

2. FBSU's Educational Goals

In accordance with its vision and mission, FBSU has established the following goal areas aims to:

- **EDUCATION GOALS**
  - Enhance the quality of faculty in strategically important academic areas
  - Improve curriculum and teaching and learning process
  - Improve teaching and learning process

- **MANAGEMENT, GOVERNANCE, AND QUALITY ASSURANCE**
  - Sustain FBSU alignment to national and international quality standards of higher education
  - Enhance quality culture and governance
  - Provide a variety of professional development opportunities for faculty and staff
- **COMMUNITY ENGAGEMENT AND OUTREACH**
  - Develop and improve FBSU's community service and education programs and initiatives
  - Enhance community engagement and outreach
- **SUSTAINABLE TECHNOLOGIES, RESOURCES AND FACILITIES**
  - Provide high quality institutional resources and facilities
  - Transform IT infrastructure and application services
  - Deliver quality library services to stakeholders
  - Maintain comprehensive and effective risk management, internal audit, and assurance framework
- **RESEARCH AND INITIATIVES**
  - Establish an effective research infrastructure
  - Play a larger role in the advancement of research and innovation
  - Contribute to the socioeconomic development of the Kingdom of Saudi Arabia through research and Innovation

3. Purpose of the Assessment Manual

The purpose of this manual is to assist FBSU faculty members and program leaders in assessing student achievement of learning outcomes in accordance with national and international accreditation standards. It serves as a comprehensive guide that:

- Provides a structured framework for assessing student learning at course, program, and institutional levels
- Establishes clear processes for developing and assessing Course Learning Outcomes (CLOs) and Program Learning Outcomes (PLOs)
- Aligns FBSU's assessment practices with NCAAA accreditation requirements
- Offers practical tools, templates, and examples for implementing effective assessment

- Supports continuous improvement of teaching and learning through systematic assessment

This manual is designed to be a practical resource that illuminates fundamental concepts and processes, provides examples and strategies for meeting specific requirements, and offers approaches for making assessment a useful means in the continuous improvement of curriculum content, teaching strategies, and assessment methods. It also provides guidance on the reporting process and expectations for all concerned parties.

4. Scope of the Learning Outcome Assessment Process

The Learning Outcome Assessment Process described in this manual is applicable to all undergraduate and graduate programs at FBSU.

5. Benefits of Learning Outcomes Assessment

The assessment of learning outcomes, when conducted properly, provides numerous benefits to all stakeholders at FBSU:

5.1 For Students:

- Clarifies expectations for learning and performance
- Ensures they master the content and skills required for their academic program
- Provides feedback on their progress toward achieving learning outcomes
- Prepares them for professional practice and lifelong learning
- Enhances the value of their degree through program accreditation

5.2 For Faculty:

- Provides data to inform improvements in teaching methods
- Offers tools to continuously enhance curriculum content and structure
- Helps identify areas where students are struggling and need additional support
- Creates opportunities for collaboration and sharing of best practices
- Supports scholarly teaching through evidence-based decision making

5.3 For the Institution:

- Demonstrates commitment to educational quality and continuous improvement
- Provides documented evidence of student learning and achievement
- Supports accreditation efforts by meeting national and international standards
- Validates that FBSU is meeting its mission and goals
- Enhances reputation and recognition in the higher education community

5.4 For Employers and Society:

- Ensures graduates possess the knowledge and skills needed for professional practice
- Increases confidence in the qualifications of FBSU graduates
- Contributes to economic development through well-prepared professionals
- Addresses the needs of the engineering profession and society

6. Terminology Used in Learning Outcome Assessment

Understanding the terminology used in learning outcome assessment is essential for effective implementation of assessment processes. The following terms are used throughout this manual:

6.1 Accreditation-Specific Terminology:

- **Program Educational Objectives (PEOs)**: Broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve within a few years after graduation.
- **Program Learning Outcomes/Student Learning Outcomes (PLOs/SLOs)**: Statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire through the program.
- **Performance Indicators (PIs):** Specific, measurable statements identifying the performance(s) required to meet the outcome; confirmable through evidence.

6.2 Assessment-Related Terms:

- **Mission**: A statement that describes the primary purpose of the program, stated in student-centered language. The program's mission should be linked to the university's mission statement.
- **Program Goals**: broad, aspirational statements that describe the *long-term vision* or purpose of a program. The program goals should be linked to the program's mission and describe the knowledge, skills, and attitudes that students should exhibit following graduation, as well as the aspirations faculty have for their graduates concerning careers and further study.
- **Program Objectives:** broad statements about desired ends for the students. The program objectives are concrete, measurable steps to achieve program goals. They specify how the goals will be accomplished. They are *Intermediate outcomes* assessed within *4–10* years.

- **Graduate Attributes** are the qualities, skills, and understandings FBSU agrees its students should develop during their journey within the institution. They are qualities that also prepare graduates as agents for social good in an unknown future.
- **Learning Outcomes**: Statements that describe what learners should know, be able to do, or value as a result of a learning experience.
- **Course Learning Outcomes (CLOs)**: Statements that describe what students are expected to know and be able to do upon successful completion of a course.
- **Program Learning Outcomes (PLOs):** Statements that describe what students are expected to know and be able to do upon successful completion of a program.
- **Institutional Learning Outcomes (ILOs):** Statements that describe the knowledge, skills, and attitudes that all students should gain through their educational experience at the institution.
- **Assessment**: The systematic collection, review, and use of information about educational programs undertaken for the purpose of improving student learning and development.
- **Direct Assessment**: Methods that evaluate student learning by examining samples of student work or performances.
- **Indirect Assessment**: Methods that evaluate student learning by gathering information through means other than direct examination of student work.
- **Evaluation**: The process of making judgments based on criteria and evidence.
- **Rubric**: A scoring tool that explicitly represents the performance expectations for an assignment or piece of work.
- **Curriculum Map**: A matrix that shows the relationship between program courses and program learning outcomes.
- **Closing the Loop**: The process of using assessment results to inform decisions about program improvements.

7. Stakeholders in Learning Outcome Assessment

The assessment of learning outcomes involves multiple stakeholders, each with unique perspectives and interests in the success and continuous improvement of education at FBSU:

7.1 Students

As the primary beneficiaries of the educational process, students have a vested interest in the quality of their education. Their feedback through surveys, focus groups, and course evaluations provides valuable insights into the effectiveness of teaching and learning. Students also participate directly in the assessment process by demonstrating their achievement of learning outcomes through various assessment methods.

7.2 Faculty

Faculty members play a central role in the assessment process. They develop course learning outcomes, design and implement assessment methods, evaluate student performance, analyze assessment results, and implement improvements based on those results. Faculty collaboration is essential for effective program-level assessment and curriculum improvement.

7.3 Department Chairs and Program Coordinators

Department chairs and program coordinators provide leadership for assessment activities within their programs. They coordinate the development of program learning outcomes, oversee the implementation of assessment plans, facilitate faculty discussions of assessment results, and ensure that assessment leads to program improvement.

7.4 College and University Administrators

Administrators at the college and university levels establish policies and provide resources to support assessment activities. They also use assessment results to inform strategic planning and resource allocation decisions.

7.5 Deanship of Quality and Academic Accreditation

The Deanship provides guidance, training, and support for assessment activities across the university. It also monitors compliance with institutional and accreditation requirements for assessment.

7.6 Employers and Industry Partners

Employers and industry partners provide valuable feedback on the knowledge, skills, and abilities needed in the workplace. Their input helps ensure that program learning outcomes remain relevant to professional practice.

7.7 Accreditation Bodies

Accreditation bodies, establish standards for assessment and evaluate the effectiveness of assessment processes during accreditation reviews.

7.8 Alumni

Alumni can provide feedback on how well their education prepared them for professional practice and further study. Their perspectives are especially valuable for evaluating program educational objectives.

8. Overview of Learning Outcome Assessment at FBSU

FBSU has adopted a comprehensive approach to learning outcome assessment that aligns with accreditation requirements and supports continuous improvement of educational programs. This approach is characterized by:

8.1 Continuous Improvement Approach

Larry Ainsworth (Rigorous Curriculum Design, 2010) words "Outcome-Based Education hinges on a clear vision of student proficiencies, followed by the intentional design of curriculum, instruction, and assessments to ensure no learner is left behind." FBSU is committed to a culture of continuous improvement in which assessment results are systematically used to enhance teaching and learning. This commitment is reflected in the university's assessment policies, processes, and practices.

8.2 PIMRU Model

FBSU ensures academic quality through: annual program reviews, periodic curriculum evaluations, and systematic assessment of learning outcomes conducted every cycle.

Learning outcomes are measured at three levels: institutional, program, and course. This multi-tiered assessment framework supports continuous improvement and reinforces quality assurance across FBSU's academic programs.

The assessment process at FBSU follows the PIMRU model (Plan → Implement → Monitor → Review → Update, Figure 1 below), which provides a structured framework for continuous improvement:

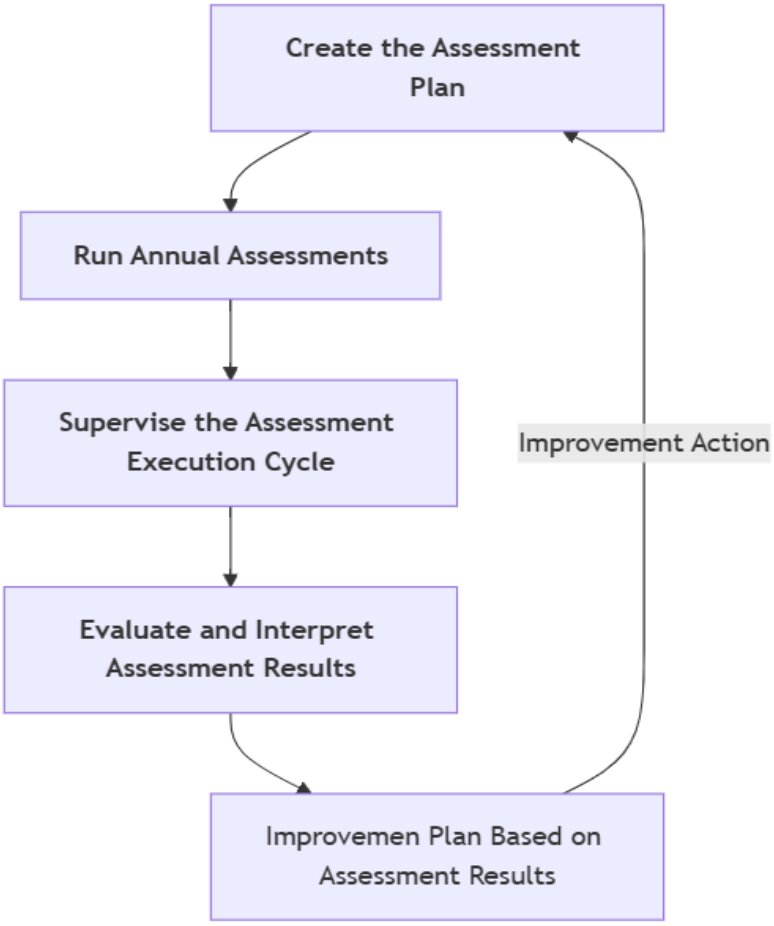


Figure 1: The PIMRU Model

- **Planning**

  In this phase, faculty develop Academic Assessment Plan (AP) that specify:

  - Learning outcomes to be assessed
  - Assessment methods to be used
  - Performance criteria and targets
  - Timeline for assessment activities
  - Responsibilities for data collection and analysis

- **Implementing**

  During this phase, faculty implement the assessment plan by:

  - Collecting assessment data using the specified methods
  - Documenting the assessment process

- Ensuring the integrity and security of assessment data

➢ **Monitoring**

The monitoring phase involves:

- Tracking the implementation of the assessment plan
- Ensuring that assessment activities are conducted as scheduled
- Identifying and addressing any issues that arise during implementation

➢ **Reviewing**

In the review phase, faculty:

- Analyze assessment data to determine the extent to which learning outcomes are being achieved
- Identify strengths and areas for improvement
- Discuss assessment results with colleagues
- Develop recommendations for improvement

➢ **Updating**

The updating phase involves:

- Implementing improvements based on assessment results
- Documenting changes made in response to assessment findings
- Evaluating the effectiveness of improvements
- Refining the assessment process for the next cycle

8.3 Program Assessment Policy

FBSU's Program Assessment Policy establishes the framework for assessing student learning outcomes at the course, program, and institutional levels. The policy applies to all academic programs (https://fbsu.edu.sa/All/Custom/Pages/Academic-Affairs) and is designed to ensure that:

1. All programs have clearly defined learning outcomes that are aligned with the university's mission and goals
2. Learning outcomes are assessed using appropriate direct and indirect methods
3. Assessment results are used to improve teaching and learning
4. Assessment processes are documented and transparent
5. Faculty, students, and other stakeholders are engaged in the assessment process
6. Assessment activities comply national and international accreditation requirements

The policy requires each program to:

1. Develop and maintain a comprehensive assessment plan
2. Conduct regular assessment of learning outcomes
3. Analyze assessment results and identify areas for improvement
4. Implement and document improvements based on assessment results
5. Report annually on assessment activities and results

8.4 Levels of Assessment

Assessment at FBSU occurs at three levels: course, program, and institutional. Each level serves a specific purpose and contributes to the overall assessment of student learning:

8.4.1 Course-Level Assessment

Course-level assessment focuses on the achievement of course learning outcomes (CLOs). It is conducted by individual faculty members for each course they teach. Course-level assessment:

- Provides immediate feedback on student learning
- Informs adjustments to teaching methods and course content
- Contributes data for program-level assessment
- Helps identify specific areas where students are struggling

8.4.2 Program-Level Assessment

Program-level assessment focuses on the achievement of program learning outcomes (SLOs/PLOs). It is coordinated by program leaders and involves all faculty teaching in the program. Program-level assessment:

- Evaluates the effectiveness of the curriculum as a whole
- Identifies strengths and weaknesses in the program
- Informs curriculum revisions and program improvements
- Provides evidence for accreditation

8.4.3 Institutional-Level Assessment

Institutional-level assessment focuses on the achievement of institutional learning outcomes (ILOs). It is coordinated by the Deanship of Quality and Academic Accreditation and involves all academic programs. Institutional-level assessment:

- Evaluates the achievement of university-wide learning goals
- Informs strategic planning and resource allocation
- Provides evidence for institutional accreditation
- Promotes alignment of program goals with institutional mission

8.5 Types of Assessment

FBSU uses both direct and indirect assessment methods to evaluate student achievement of learning outcomes:

8.5.1 Direct Assessment Methods

Direct assessment methods involve the examination of actual student work or performances to determine the extent to which students have achieved learning outcomes. These methods provide tangible evidence of student learning. Examples of direct assessment methods used at FBSU include:

- **Embedded Course Assessments**
  1. Exams and quizzes
  2. Projects and assignments
  3. Laboratory reports
  4. Presentations
  5. Design projects
  6. Capstone projects
- **Performance-Based Assessments**
  1. Demonstrations of skills
  2. Laboratory observations
  3. Field experiences
  4. Internship evaluations
- **Portfolio Assessments**
  1. Collections of student work over time
  2. Reflections on learning
  3. Evidence of achievement of learning outcomes

8.5.2 Indirect Assessment Methods

Indirect assessment methods gather information about student perceptions of their learning or about factors that contribute to learning. While they do not directly measure student achievement of learning outcomes, they provide valuable complementary information. Examples of indirect assessment methods used at FBSU include:

- **Surveys**
  1. Course evaluation surveys
  2. Program exit surveys

3. Alumni surveys
4. Employer surveys

- **Interviews and Focus Groups**

1. Student interviews
2. Focus group discussions
3. Exit interviews with graduating students

- **Institutional Data**

1. Retention and graduation rates
2. Time to degree completion
3. Job placement rates
4. Graduate school acceptance rates

8.6 Compliance with National and International Accreditation Criteria

FBSU's assessment processes are designed to comply with NCAAA accreditation criteria, particularly Student Outcomes and Continuous Improvement. The assessment framework ensures that:

1. Each program has documented student outcomes that prepare graduates to attain the program educational objectives
2. These outcomes include several number of PLOs (for engineering, ABET Student Outcomes 1-7)
3. A documented and systematic process is used to regularly assess and evaluate the extent to which student outcomes are being attained
4. Assessment results are used as input for continuous improvement of the program
5. The assessment process and its results are documented and maintained

The assessment processes described in this manual provide a structured approach for meeting these requirements and preparing for successful accreditation reviews.

8.7 Targets in Learning Outcomes Assessment

Targets define the expected level of aggregated student performance for each assessment method (direct or indirect). These benchmarks are typically quantified using numerical values or percentages.

Example: A target may specify that "at least 75% of students will score 3 or higher on all rubric criteria when evaluating research presentations.

8.8 Key Performance Indicators for Learning Outcome Assessment

FBSU has established key performance indicators (KPIs) to monitor the effectiveness of its learning outcome assessment processes. These KPIs include (Table 1):

Table 1: KPIs assessment Targets

Assessment Metric	Target
Percentage of courses with documented assessment of all CLOs	**100%**
Percentage of programs with documented assessment of all SLOs/PLOs	**100%**
Percentage of PLOs meeting performance targets	**≥ 65%**
Percentage of programs completing the assessment cycle (closing the loop)	**100%**
Student satisfaction with learning experiences	**≥ 70%**
Employer satisfaction with graduate preparation	**≥ 70%**

These KPIs are monitored semiannually/annually by the Deanship of Quality and Academic Accreditation and reported to program leaders and university administrators. They provide a basis for evaluating the effectiveness of assessment processes and identifying areas for improvement.

9. Compliance of Assessment Process with NCAAA Institutional Standards

FBSU's program and institutional assessment processes are aligned with the standards set by the National Center for Academic Accreditation and Evaluation (NCAAA). Specifically, best practices outlined in Standards 3.1, 3.2, and 3.3 are applied at both the institutional and program levels. These relevant practices are illustrated in Figure 2 below.

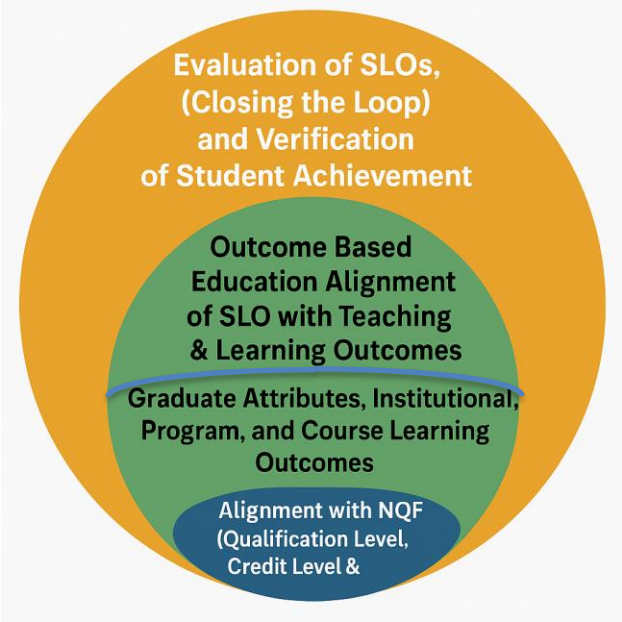


Figure 2: Quality Management System

It is also important to note that the Quality Management System (QMS) at FBSU is aligned with both the NCAAA standards and the National Qualifications Framework (NQF). The diagram referenced above illustrates this alignment. The NQF serves as a foundational guide for aligning educational practices with labor market demands by promoting quality assurance across all educational sectors. FBSU has adopted the NQF as the core framework for its university-wide quality management system.

Section II

Program Learning Outcomes (PLOs/SLOs) Assessment

1. Introduction to Program Learning Outcomes

At Fahad Bin Sultan University (FBSU), Program Learning Outcomes (PLOs) articulate the specific competencies and skills that students are expected to attain by the time of graduation. These outcomes serve as a critical foundation for ensuring academic quality and continuous improvement in student learning.

The primary objective of assessing PLOs is to enhance student learning through a systematic, evidence-based program review process. This assessment not only measures the extent to which students achieve the intended learning outcomes but also informs curriculum development and instructional strategies to better support student success.

PLOs reflect the core elements of each academic program's goals and must be aligned with the appropriate level of cognitive complexity. For instance, outcomes for graduate-level programs at FBSU should emphasize advanced cognitive abilities such as critical thinking, synthesis, and evaluation, in contrast to undergraduate programs which may focus more on foundational knowledge and application.

The development of PLOs is a collaborative process, representing the collective consensus of program faculty and should encompass:

- The knowledge, skills, and attitudes students are expected to acquire
- Alignment with national qualification frameworks and accreditation standards
- Relevance to industry and societal needs
- Support for the university's mission and strategic goals

At Fahad Bin Sultan University (FBSU), Program Learning Outcomes (PLOs) are publicly available through the academic department webpages and the university bulletin. Each program's specifications include a comprehensive **Program Map**, which outlines the alignment of the curriculum with the **National Qualifications Framework (NQF)** domains of learning. These outcomes clearly communicate to prospective students the expected knowledge, skills, and attributes they will acquire by graduation. Additionally, employers can use these defined outcomes to understand the distinctive qualities of FBSU graduates from various disciplines.

Key Considerations Prior to Finalizing PLOs:

To ensure that the PLOs meet institutional and external expectations, the following criteria must be satisfied:

- **Alignment with FBSU's Mission and Strategic Goals:** PLOs should reflect relevant components of FBSU's mission, as well as the missions of the respective college and academic department.

- **Responsiveness to Stakeholders' Needs:** PLOs must address the expectations and interests of key constituencies, including students, faculty, employers, industry partners, and advisory boards.
- **Comprehensive Scope:** PLOs should be broad and integrative, capturing the overall goals of the academic program and providing a long-term vision for student achievement.

  Compliance with Accreditation Standards: PLOs should align with the criteria of national and international accreditation bodies such as the **NCAAA**, **ABET**, **NAAB, CIDA, etc.**, and other discipline-specific frameworks as applicable.
- **Clarity and Specificity:** Each PLO must be articulated with sufficient detail to ensure clarity of purpose and relevance to the program.
- **Measurability:** PLOs must be formulated in a manner that allows for meaningful qualitative and/or quantitative assessment.
- **Adaptability:** PLOs should be flexible enough to accommodate future changes in stakeholder expectations, industry trends, and the evolving mission of the university.
- **Public Dissemination:** Finalized PLOs must be published and widely accessible—via the program's official website, promotional materials, student handbooks, and communications with alumni and employers.

2. Program Learning Outcomes Assessment

The Program Learning Outcomes (PLOs) are directly aligned with the national and international Student Outcomes as *an example for engineering programs* it is defined in Criterion 3 of the ABET Accreditation Criteria. This alignment ensures that our programs meet international standards for engineering education and prepare graduates for successful professional careers.

1. **SLO1-Problem Solving:** An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. **SLO2-Design**: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. **SLO3-Communication**: An ability to communicate effectively with a range of audiences.
4. **SLO4-Ethics and Professional Responsibility**: 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. **SLO5-Teamwork**: 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. **SLO6-Experimentation and Data Analysis**: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. **SLO7-Lifelong Learning**: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Further, the Program Learning Outcomes (PLOs) across all academic programs at FBSU are systematically aligned with the **National Qualifications Framework (NQF)** as mandated by the **National Center for Academic Accreditation and Evaluation (NCAAA)**. The NQF requires that all PLOs comprehensively address the three core learning domains:

1. **Knowledge** – covering factual and theoretical understanding relevant to the discipline.
2. **Skills** – focusing on cognitive and practical abilities such as problem-solving, analysis, and application.
3. **Values** – encompassing ethical behavior, teamwork, responsibility, and lifelong learning.

This tri-domain structure ensures that graduates are not only competent in their technical fields but also demonstrate the professional and ethical attributes necessary for real-world success.

For example, the NCAAA-aligned PLOs for engineering programs typically include:

- Applying mathematical, scientific, and engineering principles (Knowledge)
- Designing experiments, analyzing data, and solving complex engineering problems (Skills)
- Demonstrating ethical responsibility, effective communication, and the ability to work in multidisciplinary teams (Values)

By aligning with NQF and NCAAA standards, FBSU ensures its graduates meet national academic benchmarks and are prepared for both local and international professional environments. Example of PLOs alignment with NCAAA for **engineering programs** as follows:

Table 1: NCAAA Program Learning Outcomes (PLOs) For Civil Engineering.

Knowledge and Understanding	
K1	Gain knowledge of mathematics, science, and engineering.
K2	Outline engineering problems solutions based on the principles of physical sciences and mathematics.
K3	Describe and categorize engineering related contemporary issues.

Skills	
S1	Solve engineering problems by applying principles of mathematics, science, and engineering.
S2	Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
S3	Apply modern techniques and skills to produce solutions in global, economic, environmental, and societal contexts for engineering practice.
S4	Acquire and apply life-long learning skills as needed, using appropriate learning strategies.
S5	Communicate effectively with a range of audiences.
Values	
V1	Uphold ethical and professional responsibilities.
V2	Function and contribute effectively in a team.

These outcomes represent the **knowledge, skills, and values that all engineering** students at FBSU are expected to demonstrate by the time of graduation. They form the foundation for curriculum development, teaching strategies, and assessment processes.

3. Program Assessment Process Using PIMRU Model.

At FBSU, the Program Learning Outcomes (PLOs) assessment process follows the PIMRU model: **Planning, Implementing, Measuring, Reviewing (Auditing), and Updating (Closing the Loop)**. This model ensures systematic, evidence-based continuous improvement aligned with the university's mission and national quality standards.

3.1 Planning

1. A clearly documented assessment plan is essential for maintaining consistency and clarity throughout the assessment process. It specifies who is responsible, what actions are taken, and when—ensuring all tasks are executed efficiently and on schedule.
2. Each academic program must prepare annual assessment plan ensuring that all PLOs are assessed using direct and indirect methods within the designated cycle. Each year, a subset of PLOs is selected for focused assessment.
3. The Program Assessment Committee **(PAC)** identifies the most appropriate core or capstone courses for evaluating the selected PLOs. These courses must have significant contributions to the targeted outcomes.
4. All PLOs must be aligned with the **National Qualifications Framework (NQF)** under the required learning domains: **Knowledge**, **Skills**, and **Values**.

5. The initial PAC-prepared assessment plan is submitted to the Department Chair, reviewed by the Department Council, and forwarded to the College Council for approval.
6. Once endorsed, the plan is submitted to the university-level Program Assessment Committee (Quality Committee members) for coordination and implementation oversight.
7. Each semester, the instructors of selected courses prepare detailed Course Assessment Plans that identify the relevant CLOs, their alignment to PLOs, and the specific assessment tools and methods used.
8. Target benchmarks for both direct and indirect methods are defined and documented using the FBSU Template for Planning PLO Assessment.

3.2 Implementing

1. The approved program assessment plan is executed using **direct methods** (e.g., rubrics, evaluations) and **indirect methods** (e.g., course or program exit surveys).
2. Departments have the autonomy to select the most appropriate tools to measure learning outcomes, provided these tools align with accepted academic standards.
3. Results from direct assessments (e.g., rubric scores) are compiled, aggregated, and compared against established benchmarks.
4. Indirect assessment data (e.g., institutional surveys) are also aggregated and analyzed independently per survey.
5. Course Learning Outcome Surveys serve as an additional indirect tool to assess student learning.
6. By the end of each semester, instructors must submit both direct and indirect assessment results for the PLOs under review.
7. The PAC consolidates all findings and prepares an annual Assessment Report in line with NCAAA standards, detailing achievement levels and areas needing attention.

3.3 Reviewing (Auditing) and Updating (Closing the Loop)

To support ongoing program improvement, FBSU integrates a robust review and update mechanism:

1. The PAC or Quality Committee (QC) reviews the assessment results and proposes recommendations for improvement or identifies effective practices worth sustaining.
2. These recommendations are included in the Annual Program Report, reviewed and endorsed by the Department Chair.

3. Assessment findings are submitted to the Deanship of Quality Assurance and Accreditation (DQAA) for centralized monitoring, feedback, and institutional alignment.
4. The DQAA conducts an **annual audit**, summarizing key findings, challenges, and recommended actions for continuous enhancement.
5. All documents and data are archived to ensure transparency, accountability, and institutional memory.

Figure 3 shows the visual representation of the PLO assessment process's process flow based on the PIMRU cycle.

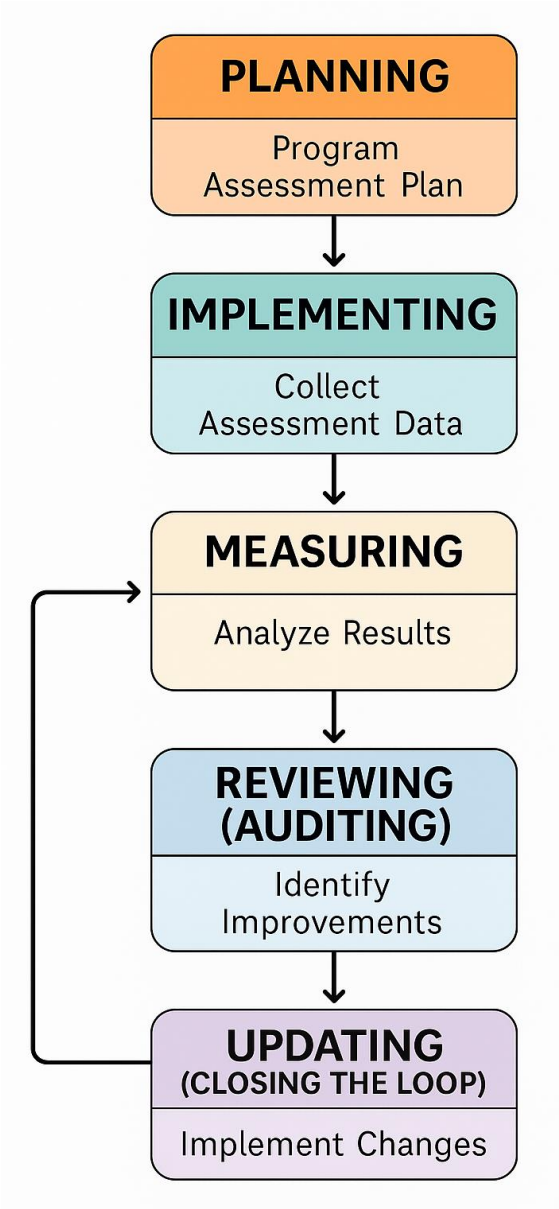


Figure 3: PLO assessment process's process flow based on the PIMRU cycle

Table 2 below highlights what is expected based upon the PIMRU cycle (Planning, Implementing, Monitoring, Reviewing, and Updating).

Table 2: PLO Assessment Process and Reporting Requirements

Phase	Action Item	Documents Required	Timeline	Responsibility
Plan & Develop	1. Develop/Update PLOs aligned with NQF and institutional standards	Program Specifications (reviewed for currency)	Beginning of academic year/semester	Curriculum Committee & Department Chairs
	2. Map PLOs to Institutional Learning Outcomes (ILOs)	PLO-ILO Matrix	Beginning of academic year/semester	Curriculum Committee & Department Chairs
	3. Create curriculum map linking courses to PLOs	Curriculum Map	Beginning of academic year/semester	Curriculum Committee & Department Chairs
	4. Design assessment timeline, instruments, and targets	Program Assessment Plan	Beginning of academic year/semester	PAC & Department Chairs
Implement	5. Collect student performance data using approved tools	PLO Assessment Results (per semester)	During academic semesters	PAC & Faculty
Monitor & Review	6. Analyze PLO results and recommend improvements	Annual Program Report (Section B)	End of academic year	PAC
	7. Share results with stakeholders (e.g., departments, committees)	Meeting minutes, reports	End of academic year	PAC & Department Chairs
Update & Improve	8. Implement minor/major program updates based on findings	Approval forms (e.g., curriculum changes)	Beginning of academic year	Department & Relevant Committees
	9. Revise program/course specifications as needed	Updated Program/Course Specifications	Beginning of academic year	Department & Curriculum Committee

4. PLO Assessment Plan

The assessment of Student Outcomes is a systematic and ongoing process that involves multiple methods and stakeholders. The process is designed to provide meaningful data for continuous improvement of the engineering programs.

4.1 Assessment Cycle

The evaluation of program effectiveness at FBSU follows a rigorous assessment cycle designed to ensure continuous improvement and alignment with national or international program accreditation standards. This cycle measures the extent to which Program Learning Outcomes (PLOs) are achieved through course assessments, student performance, and stakeholder feedback.

Although all academic programs at FBSU are expected to participate in annual assessment activities, not every Program Learning Outcome (PLO) must be assessed each year. Programs should establish a systematic two- or four-year assessment cycle to ensure comprehensive evaluation of all PLOs over time. However, programs with specialized international accreditation may be required by their accrediting bodies to assess all PLOs semi-annually/annually and must adhere to those specific standards.

Example of a Multi-Year Assessment Cycle for a program with **7 PLOs**, the cycle could be structured in Table 3 as follows:

Table 3: Assessment cycle for 4 years (Example assessment plan)

Assessment Year	Standard 4-Year Cycle	Accelerated 2/3-Year Cycle	Comprehensive Annual Cycle*
Year 1	PLOs 1 & 2	PLOs 1, 2, 3 & 4	PLOs 1, 2, 3, 4, 5, 6 & 7
Year 2	PLOs 3, 4 & 5	PLOs 5, 6 & 7	Repeat cycle
Year 3	PLOs 6 & 7	Repeat cycle	-
Year 4	Repeat cycle		

Note: Comprehensive annual assessment is required for programs with specialized international accreditation

This staggered approach allows programs to:

1. Analyze assessment findings thoroughly,
2. Implement targeted improvements, and
3. Refine strategies before reassessing the same PLOs in the next cycle.

Outcome: A closed-loop system that ensures continuous program improvement and student readiness for industry and research challenges.

This cycle ensures that all outcomes are regularly assessed while distributing the assessment workload over multiple years.

4.2 Direct Assessment Methods

It is mandatory to use only the core courses for assessing the PLOs. In addition to that, it is preferable to use the courses at the mastery level for the assessment purpose. Direct assessment methods provide tangible evidence of student achievement of the Student Outcomes. The following direct methods are used at FBSU:

- **Course-Embedded Assessments**: Specific assignments, exam questions, or projects in selected courses are used to assess student performance on the performance indicators associated with each outcome.
- **Capstone Projects**: Comprehensive design projects completed in the senior year are evaluated using rubrics aligned with the ABET Student Outcomes.
- **Portfolio Assessment**: Collections of student work from multiple courses are evaluated to assess development and achievement of outcomes over time.
- **Standardized Tests**: Where applicable, standardized tests such as the Exit Exams are used to provide external validation of student achievement.

4.3 Indirect Assessment Methods

Indirect assessment methods provide additional perspectives on student achievement of the ABET Student Outcomes. The following indirect methods are used at FBSU:

- **Exit Surveys**: Graduating seniors complete surveys that ask them to self-assess their achievement of each outcome.
- **Alumni Surveys**: Graduates are surveyed 2-5 years after graduation to assess how well the program prepared them for professional practice.
- **Employer Surveys**: Employers of FBSU graduates are surveyed to assess graduate performance related to the outcomes.
- **Advisory Board Feedback**: The Engineering Advisory Board provides feedback on the relevance and achievement of the outcomes.

4.4 Performance Targets

For each assessment method, performance targets are established to determine whether student achievement of the outcomes is satisfactory. Typical targets include:

- **Direct Assessments**: At least 65% of students achieve a score of 3 or higher on a 4-point scale for each performance indicator.
- **Exit Surveys**: At least 70% of graduating seniors report that they are "well prepared" or "very well prepared" in each outcome area.
- **Alumni and Employer Surveys**: At least 70% of respondent rate graduate performance as "satisfactory" or "excellent" for each outcome.

4.5 Using Assessment Results for Continuous Improvement

Assessment results are analyzed by program faculty to identify strengths and areas for improvement. When performance targets are not met, faculty develop and implement action plans to address the identified weaknesses. These action plans may include:

- Revisions to curriculum content or sequence
- Changes in teaching methods or learning activities
- Additional resources or support for students
- Modifications to assessment methods or tools

The effectiveness of these improvements is evaluated in subsequent assessment cycles, completing the continuous improvement loop.

5. Mapping PLO/ Student Outcomes to Curriculum

Once PLOs are established, they must be systematically mapped to the curriculum. This process:

- Illustrates program coherence across introductory (I), developing (P), and mastery (M) levels
- Tracks students' progressive learning journey
- Ensures alignment between courses, outcomes, and assessments
- Identifies potential gaps in curriculum coverage

5.1 Key Benefits of Curriculum Mapping

1. Reveals under-addressed or missing learning outcomes, prompting:
   - PLO refinements
   - Course redesign
   - Curriculum modifications
2. Identifies optimal points for:
   - Embedded assessment opportunities
   - Data collection through existing assignments/activities
3. Guides continuous improvement after data analysis

5.2 Curriculum Map Definition

A matrix documenting:

- Where each PLO is addressed in the curriculum
- The complexity level (I, P, M) of achievement
- Designated assessment points ("A")

Five-Step Mapping Process is depicted in Table 4.

Table 4: Five-Steps Curriculum to PLOs Mapping Process

Step	Action	Details	Responsible
1	Gather Materials	• Approved PLOs • Complete course list (required & elective) • Key experiences (internships, capstones, etc.)	Program Faculty
2	Create Matrix Template	Use Excel/Word table with: • PLOs as rows • Courses as columns	Assessment Coordinator
3	Code Learning Progression	I = Introduced P = Practiced (reinforced through activities) M = Mastered (demonstrated competence) A = Assessment point	Course Instructors
4	Review& Validate	Faculty analyze map to ensure: • Logical skill progression • Adequate mastery opportunities • At least one "A" per PLO	Curriculum Committee
5	Implement Assessment Plan	Align data collection with mapped "A" points per assessment cycle	Program Assessment Team

Critical Notes:

- Not all outcomes are assessed each semester (follow approved cycle)
- Accredited programs must comply with discipline-specific requirements

Some programs can assign adjustable numerical weights to quantify each course's contribution to a specific Student Learning Outcome (SLO), Program Learning Outcome (PLO), or Performance Indicator (PI). By applying a weighted average approach, the total contributions of different courses are combined to numerically assess the overall achievement of the designated PLO.

5.3 Example Curriculum Map Format

An example of a curriculum map is engineering programs where each map show how the ABET Student Outcomes and the NCAAA PLO are addressed across the curriculum. This map identifies:

- Which courses contribute to each outcome
- The level of emphasis on each outcome in each course (Contribution weight %)
- The assessment points for each outcome see Table 5 for the mapping for the Civil Engineering program
- Form the mapping matrix we see that each SLO was divided to several measurable Performance indicators and this are optional process and program oriented model.

- All these PIs are weighted averaged to collect the effect of each PI to the corresponding SLO.

Table 5: Curriculum mapping for bachelor of Civil Engineering Program

Course Code	ABET SLOs	ABET-SLO1			ABET-SLO2		ABET-SLO3	ABET-SLO4		ABET-SLO5		ABET-SLO6		ABET-SLO7
	ABET PI	PI 1-a	PI 1-b	PI 1-c	PI 2-a	PI 2-b	PI 3	PI 4-a	PI 4-b	PI 5-a	PI 5-b	PI 6-a	PI 6-b	PI 7
	NCAAA PLOs	K1	K2	S1	S3		S5	V1	K3	V2		S2		S4
CHEM 101	General Chemist	100	100	100										
MATH 100	Mathematics I	100	100	100										
MATH 201	Calculus and Ana	100		100										
MATH 215	Linear Algebra ar	100	100	100										
MATH 102	Calculus II	100	100	100										
MATH 202	Differential Equa	100	100	100										
MATH 101	Calculus I	100	100	100										
PHYS 101	General Physics I	100		100										
PHYS 102	General Physics I	100		100										
CSC 101	Introduction to C	100					70							
STAT 230	Probability and S	100	100	100										
CIVE 205	Engineering Drav	100								70	70			
CIVE 210	Statics	100		100										
CIVE 211	Structural Mecha	100		100										
CIVE 215	Computer Aided	100					70							
CIVE 220	Engineering Mat	100			100									
CIVE 240	Fluid Mechanics	100		100										
CIVE 250	Environmental E	100			90	70								
CIVE 260	Spatial Measurer	100												
CIVE 310	Structural Analys	100		100										
CIVE 320	Concrete I	100		100										
CIVE 330	Geotechnical Eng	100												
CIVE 351	Water and Waste	100			100	70								
CIVE 360	Transportation E	100		100										
CIVE 412	Steel Design	100		100										
CIVE 430	Foundation Engi	100	100	100										
CIVE 460	Highway Enginee	100		100										
CIVE 471	Quantity Surveyi	100		100										
CIVE 480	Construction Ma	100		100		100								
CIVE 461	Pavement Desigr	100		100	100									
PHYS 103L	Physics Lab	100								100		100		
CIVE 472	Contracts and Sp	100				100			100					
CIVE 420	Concrete II	100		100										
ELEE 230	Programming for Engine		100	100									70	
CIVE 400	Summer Internship for C		100				100	100	100	100	100			100
CIVE 498	Final Year Project I		100		100	100	100	100	100	100	100	100	100	
COEN 300	Engineering Economy		100		90				100					
CIVE 410	Structural Analysis II		65	100										
CIVE 499	Final Year Project II				100	100	100	100	100	100	100	100	100	
ARAB 101	Basic Academic Arabic						70							70
ARAB 201	Advanced Academic Arabic						80							80
ENGL 100	General English						80							80
ENGL 101	Basic Academic English I						80			80				
ENGL 102	Basic Academic English II						80			80				
ENGL 203	Advanced Academic English I						85							85
ENGL 206	Technical Writing						90	90		90				90
COEN 401	Communication skills and Ethics						70	100	70					
SOCS 202	World Civilizations						70							70
CIVE 220L	Engineering Materials Lab									100		100	100	
CIVE 240L	Fluid Lab									100		100	100	
CIVE 260L	Surveying Lab									80		100	100	
CIVE 330L	Geotechnical Engineering Lab									100		100	100	
CHEM 101L	General Chemistry Lab									100		100		

The curriculum map ensures that all outcomes are adequately addressed in the curriculum and that students have multiple opportunities to develop and demonstrate the knowledge, skills, and behaviors associated with each outcome. Table 6 presents the mapping matrix for the Civil Engineering program, illustrating the course contributions to each Performance Indicator (PI), Student Learning Outcome (SLO), and Program Learning Outcome (PLO). These contributions were determined by instructors and approved by the Program Quality Committee (PAC).

For example, **PLO-S5** (linked to **PI3** and **SLO3**) receives contributions from **15 courses** in the curriculum, each with varying weights.

Table 6: The mapping matrix for the Civil Engineering program

ARAB 101	ARAB 201	CIVE 215	CIVE 499	COEN 401	CSC 101	ENGL 100	ENGL 101	ENGL 102	ENGL 203	ENGL 206	SOCS 101	SOCS 201	SOCS 202	SOCS 203
70%	80%	70%	100%	70%	70%	80%	80%	80%	85%	90%	70%	70%	70%	70%

To compute the **weighted average achievement** for **S5**, only the assessed courses in a given semester are considered. Suppose the following courses were assessed with their achieved direct respective results (*course assessment results CAR*):

- **ARAB 201**: 72%
- **CIVE 215**: 88%
- **CSC 101**: 67%
- **ENGL 206**: 77%

The total achieved assessment for **S5** is calculated as: Achievement level for

$$\textbf{\textit{Achievement level for S5}} = \frac{\sum_{i=1}^{n}[\,\boldsymbol{w_i}] * [\boldsymbol{CAR_i}]}{\sum_{i=1}^{n}[\boldsymbol{w_i}]}$$

Where:

- $\boldsymbol{n}$= number of assessed course in a semester
- $\boldsymbol{w_i}$ = Course contribution weight (shown in the Mapping Matrix)
- $\boldsymbol{CAR_i}$ = Course assessment result

$$\%Results\ for\ S5 = \frac{\sum_{i=1}^{n=4}[\,w_i] * [CAR]}{\sum_{i=1}^{n=4}[w_i]}$$

$$= \frac{(0.72 * 80) + (0.88 * 70) + (0.67 * 70) + (0.77 * 90)}{80 + 70 + 70 + 90} = 75.9\%$$

Which means that PI3/ S5 has achieved by 75.9%> 65% (the target threshold), PI3/**S5** has been successfully achieved.

6. Closing the Loop, Documentation and Reporting

At Fahad Bin Sultan University (FBSU), a complete assessment cycle typically spans 2 to 4 years (special cycles for international accreditations) to effectively close the loop on student achievement of the Program Learning Outcomes (PLOs). This timeframe allows for the systematic collection of assessment data, meaningful analysis, implementation of improvements, and re-evaluation of outcomes.

The process of closing the loop at the program level at FBSU follows a structured model consistent with national standards, ensuring that improvements in student learning are evidence-based, iterative, and aligned with the NCAAA and NQF frameworks.

Figure 4, describes the process of closing the loop at FBSU at the program levels.

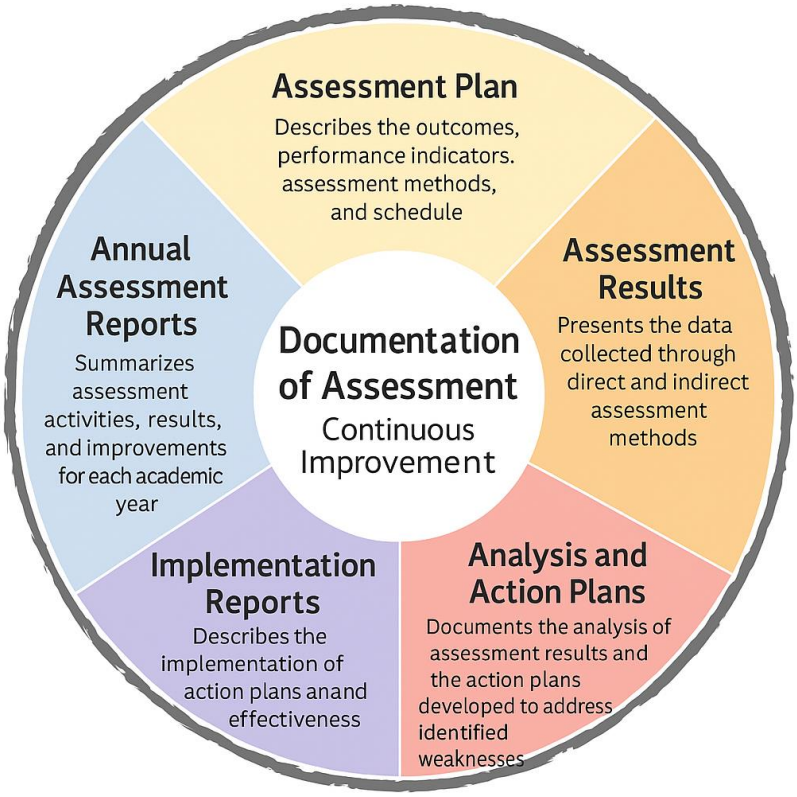


Figure 4: Closing the Loop

Documentation of the assessment of Student Outcomes is essential for both internal improvement processes and external accreditation reviews. The following documentation is maintained for each engineering program:

1) **Assessment Plan**: Describes the outcomes, performance indicators, assessment methods, and schedule.
2) **Assessment Results**: Presents the data collected through direct and indirect assessment methods.

3) **Analysis and Action Plans**: Documents the analysis of assessment results and the action plans developed to address identified weaknesses.
4) **Implementation Reports**: Describes the implementation of action plans and their effectiveness.
5) **Annual Assessment Reports**: Summarizes assessment activities, results, and improvements for each academic year.

These documents provide a comprehensive record of the assessment process and demonstrate the program's commitment to continuous improvement based on assessment results.

7. Conclusion

The adoption of Student Outcomes as Program Learning Outcomes for FBSU's engineering programs ensures alignment with international standards for engineering education. The systematic assessment of these outcomes provides valuable information for continuous improvement of the programs and prepares the programs for successful accreditation reviews. By focusing on these outcomes, FBSU demonstrates its commitment to preparing graduates who possess the knowledge, skills, and behaviors needed for successful professional practice in engineering.

Section III

Course Learning Outcomes (CLOs) Development

1. Principles of Effective CLO Development

Course Learning Outcomes (CLOs) are specific statements that describe what students should know and be able to do upon successful completion of a course. Well-designed CLOs are essential for effective teaching, learning, and assessment as they provide clear expectations for students and serve as the foundation for evaluating student achievement.

The following principles should guide the development of effective CLOs for engineering courses at FBSU:

1.1 Alignment with ABET/NQF Student Outcomes

CLOs should align with and contribute to the achievement of the Student Outcomes adopted as Program Learning Outcomes (PLOs) and aligned with the teaching and assessment strategies within the National Qualification Framework (NQF). Each course in the curriculum should be designed to help students develop specific knowledge, skills, and behaviors related to one or more of the PLOs.

1.2 Specificity and Clarity

CLOs should be specific and clearly stated, avoiding vague or ambiguous language. They should precisely describe the knowledge, skills, or behaviors that students are expected to demonstrate. Clarity helps both instructors and students understand what is expected.

Example of a vague CLO: "*Students will understand circuit theory*."

Example of a specific CLO: "*Students will be able to analyze DC and AC circuits using Kirchhoff's laws, nodal analysis, and mesh analysis*."

1.3 Measurability

CLOs should be measurable, meaning that student achievement of the outcome can be observed and assessed. Measurable outcomes facilitate the development of appropriate assessment methods and tools.

Example of a non-measurable CLO: "*Students will appreciate the importance of engineering ethics.*"

Example of a measurable CLO: "*Students will be able to identify ethical issues in engineering case studies and propose solutions that adhere to professional codes of ethics.*"

1.4 Achievability

CLOs should be achievable within the scope and timeframe of the course. They should represent realistic expectations for what students can accomplish given the available resources, time constraints, and prerequisite knowledge.

1.5 Relevance

CLOs should be relevant to the discipline, program, and course. They should reflect essential knowledge and skills that contribute to the broader program learning outcomes and prepare students for subsequent courses or professional practice.

1.6 Time-bound

CLOs should be attainable within the duration of the course. They represent what students should be able to demonstrate by the end of the course, not what they might achieve in the future.

2. Using Bloom's Taxonomy in Writing CLOs

Bloom's Taxonomy is a hierarchical framework that categorizes educational goals according to their cognitive complexity. It provides a useful structure for developing CLOs that represent different levels of cognitive engagement and for ensuring that courses include an appropriate mix of lower-order and higher-order thinking skills.

2.1 Levels of Bloom's Taxonomy

The revised Bloom's Taxonomy includes six levels of cognitive processes, arranged from lower-order to higher-order thinking skills (Figure 5):

Figure 5: Bloom's Taxonomy cognitive processes

- **Remember**: Retrieving relevant knowledge from long-term memory

  Action verbs: Define, list, recall, recognize, identify, name, state

- **Understand**: Constructing meaning from instructional messages

Action verbs: Explain, describe, interpret, summarize, classify, compare, contrast, and paraphrase

- **Apply**: Carrying out or using a procedure in a given situation

  Action verbs: Apply, implement, use, execute, solve, demonstrate, compute, calculate

- **Analyze**: Breaking material into constituent parts and determining how parts relate

  Action verbs: Analyze, differentiate, organize, attribute, distinguish, examine, test, and investigate

- **Evaluate**: Making judgments based on criteria and standards

  Action verbs: Evaluate, critique, judge, assess, appraise, recommend, justify, defend

- **Create**: Putting elements together to form a coherent or functional whole

  Action verbs: Design, construct, produce, plan, develop, formulate, invent, compose

2.2 Using Bloom's Taxonomy in CLO Development

When developing CLOs for engineering courses at FBSU, consider the following guidelines related to Bloom's Taxonomy:

Use appropriate action verbs: Select verbs that clearly indicate the cognitive level expected of students. Avoid vague verbs like "understand" or "know" in favor of more specific verbs that indicate observable behaviors.

Include a mix of cognitive levels: Ensure that the course includes CLOs at various levels of Bloom's Taxonomy, appropriate to the course level and position in the curriculum. Introductory courses may emphasize lower levels, while advanced courses should include more high-level outcomes.

Align cognitive levels with assessment methods: Ensure that assessment methods are appropriate for the cognitive level of each CLO. For example, multiple-choice questions may be suitable for assessing "remember" and "understand" levels, while projects or case studies are more appropriate for "analyze," "evaluate," and "create" levels.

Consider the progression of cognitive levels: Within a course, consider how students will progress from lower to higher cognitive levels. Early in the course, focus on building foundational knowledge and understanding, then move toward application, analysis, evaluation, and creation.

2.3 Examples of CLOs at Different Bloom's Taxonomy Levels for Engineering Courses

2.3.1 Civil Engineering Examples:

Remember:

- "List the fundamental principles of soil mechanics."

- "Identify the components of a reinforced concrete beam."

Understand:

- "Explain the behavior of structures under different loading conditions."
- "Describe the relationship between stress and strain in structural materials."

Apply:

- "Calculate the forces and moments in statically determinate structures."
- "Apply appropriate design codes to size structural elements."

Analyze:

- "Analyze the stability of slopes using limit equilibrium methods."
- "Differentiate between various foundation types based on soil conditions and structural requirements."

Evaluate:

- "Evaluate alternative transportation system designs based on efficiency, cost, and environmental impact."
- "Assess the adequacy of a water distribution system for a given community."

Create:

- "Design a reinforced concrete structure that meets specified requirements."
- "Develop a comprehensive stormwater management plan for an urban development."

2.3.2 Electrical Engineering Examples:

Remember:

- "List the fundamental laws of electrical circuits."
- "Identify the components of a feedback control system."

Understand:

- "Explain the principles of operation of DC motors."
- "Describe the characteristics of semiconductor devices."

Apply:

- "Solve circuit problems using Kirchhoff's laws and nodal analysis."
- "Implement digital logic designs using appropriate hardware."

Analyze:

- "Analyze the performance of communication systems under various noise conditions."

- "Differentiate between various modulation techniques based on bandwidth efficiency and noise immunity."

Evaluate:

- "Evaluate the stability of control systems using appropriate criteria."
- "Assess the power quality of electrical distribution systems."

Create:

- "Design a digital circuit that performs a specified function."
- "Develop a microcontroller-based system to solve a real-world problem."

2.3.3 Mechanical Engineering Examples:

Remember:

- "List the fundamental laws of thermodynamics."
- "Identify the components of a hydraulic system."

Understand:

- "Explain the principles of heat transfer in engineering applications."
- "Describe the behavior of mechanical systems under dynamic loading."

Apply:

- "Calculate the efficiency of thermal cycles."
- "Apply appropriate design factors in machine element design."

Analyze:

- "Analyze the stress distribution in mechanical components under combined loading."
- "Differentiate between various failures modes in mechanical systems."

Evaluate:

- "Evaluate the performance of HVAC systems based on energy efficiency and comfort criteria."
- "Assess the reliability of mechanical systems using statistical methods."

Create:

- "Design a mechanical system that meets specified requirements."
- "Develop a manufacturing process plan for a given product."

2.3.4 Renewable Energy Engineering Examples:

Remember

- "List the main types of renewable energy sources."

- "Identify the key components of a solar photovoltaic (PV) system."
- "Recall the basic principles of wind turbine operation."

Understand

- "Explain how solar panels convert sunlight into electricity."
- "Describe the working principle of a geothermal heat pump."
- "Summarize the advantages and disadvantages of biomass energy."

Apply

- "Calculate the energy output of a wind farm given wind speed and turbine specifications."
- "Apply the Betz limit to determine the maximum efficiency of a wind turbine."
- "Design a small-scale solar power system for a residential home."

Analyze

- "Compare the efficiency of monocrystalline vs. polycrystalline solar panels."
- "Analyze the impact of temperature on battery storage performance in solar systems."
- "Differentiate between grid-tied and off-grid renewable energy systems."

Evaluate

- "Assess the feasibility of a hydroelectric project based on environmental and economic factors."
- "Evaluate the cost-effectiveness of a hybrid solar-wind energy system for a remote location."
- "Critique the sustainability of biofuel production methods."

Create

- "Design a microgrid system integrating solar, wind, and battery storage for a rural community."
- "Develop a proposal for optimizing energy efficiency in a smart grid with renewable sources."
- "Invent a novel method for improving tidal energy capture efficiency."

2.3.5 Master of Civil Engineering Examples:

Remember

- "List the primary load combinations used in LRFD (Load and Resistance Factor Design)."

- "Identify the key components of a reinforced concrete beam."
- "Recall the standard tests for determining soil bearing capacity."

Understand

- "Explain the difference between ultimate limit state (ULS) and serviceability limit state (SLS) in structural design."
- "Describe the mechanism of liquefaction in seismic events."
- "Summarize the principles of sustainable construction practices."

Apply

- "Calculate the deflection of a steel beam under a given load using the moment-area method."
- "Apply the AASHTO method to design a flexible pavement structure."
- "Use finite element analysis (FEA) software to model stress distribution in a bridge component."

Analyze

- "Compare the effectiveness of different foundation types (shallow vs. deep) for high-rise buildings on soft soil."
- "Analyze the impact of traffic flow changes on intersection level of service (LOS)."
- "Interpret the results of a sieve analysis to classify soil type."

Evaluate

- "Assess the environmental impact of a proposed highway expansion using life-cycle assessment (LCA)."
- "Evaluate the seismic retrofit strategies for an aging concrete structure."
- "Critique the cost-benefit analysis of using high-performance concrete in bridge construction."

Create

- "Design a multi-story steel-framed building to meet ASCE specifications."
- "Develop a construction schedule using critical path method (CPM) for a large-scale infrastructure project."
- "Propose an innovative stormwater management system for a flood-prone urban area."

3. Alignment of CLOs with Student Outcomes

One of the most critical aspects of CLO development is ensuring alignment with Student Outcomes (adopted as PLOs at FBSU). This alignment creates a coherent educational experience for students and facilitates program-level assessment.

3.1 Importance of Alignment

Alignment between CLOs and Student Outcomes ensures that:

- Each course contributes meaningfully to program-level outcomes
- Students have opportunities to develop and demonstrate all program-level outcomes
- Assessment data collected at the course level can inform program-level assessment
- The curriculum as a whole provides a coherent and comprehensive educational experience

3.2 Process for Aligning CLOs with Student Outcomes

The process for aligning CLOs with Student Outcomes involves the following steps:

- Review Student Outcomes: Begin by thoroughly understanding the Student Outcomes and their performance indicators (if any) as described in Section II of this manual.
- Identify the outcomes that the course should address: Based on the course's position in the curriculum and its content, determine which Student Outcomes the course should contribute to. Not every course needs to address all outcomes.
- Develop CLOs that support the identified outcomes: Create CLOs that, when achieved, will help students progress toward attaining the relevant Student Outcomes.
- Create a mapping matrix: Document the relationship between CLOs and Student Outcomes in a mapping matrix that shows which CLOs contribute to each outcome.
- Review and refine: Periodically review the alignment to ensure that it remains appropriate as the course and program evolve.

3.3 CLO-PLO (/SLO/PIs) Mapping Matrix

A CLO-PLO (SLO; PIs) mapping matrix is a tool for documenting the alignment between course-level outcomes and ABET Student Outcomes. The matrix typically uses a numerical scale to indicate the strength of the relationship between each CLO and PLO.

For example:

- 80-100 = Strong contribution (the CLOs significantly contributes to the PLO/PI/SLO)
- 70-80 = Moderate contribution (the CLO moderately contributes to the PLO/PI/SLO)
- 50-70 = Weak contribution (the CLO minimally contributes to the PLO) /PI/SLO
- Blank = No contribution

Table 7 is an example of a CLO-PLO mapping matrix for a Thermodynamics course in Mechanical Engineering:

Table 7: Relationship of CLO to Program Outcomes (PLO/SLO/PI)

ABET SLOs	1					2	3		4	5		6		7	
PIs	1a	1b	1c			2a	2b	3	4a	4b	5a	5b	6a	6b	7
NCAAA PLOs	K1	K2	S1			S3		S5	V1	K3	V2		S2		S4
PIs-Weight (%)	25	35	40			55		45	100	55	45		60		40
Course Contribution %		75	90												
CLOs		1	2	3	4										
CLOs-Weight (%)		100	30	20	50										

This matrix illustrates how each **Course Learning Outcome (CLO)** contributes to the respective **Student Outcomes PIs, NCAAA-PLOs, ABET-SLOs**, including the relative weight of each contribution. It ensures comprehensive coverage of all required outcomes within the course and establishes a structured framework for course-level assessments, which in turn support program-level evaluation.

Example:

This course strongly contribute to the outcome (**S1**) **PI1-c** – weight average =90% and moderately contribute to the outcome (**K2**) **PI1-b** – weight average = 75%

As far for the course learning outcomes CLOs:

CLO1 contributes by **100%** to the outcome **PI1-b (K2)**
CLO2 contributes **30%** to the outcome **PI1-c** (**S1**)
CLO3 contributes **20%** to **PI1-c** (**S1**)
CLO5 contributes **50%** to **PI1-c** (**S1**)

When combined, these contributions provide **100% coverage** of **PI1-b** and **100%** for **PI1-c**, enabling accurate calculation of the course's achievement toward this outcome during assessment.

The table specifies weight allocations for PIs relative to their PLOs. For instance, ABET-SLO1 aggregates three PIs with distinct weights (PI 1-a: 25%, PI 1-b: 35%, PI 1-c: 40%), where the PLO's final score reflects their weighted combination.

4. Measurability and Specificity in CLOs

Measurability and specificity are essential characteristics of effective CLOs. They ensure that student achievement can be objectively assessed and that expectations are clear to both students and instructors.

4.1 Characteristics of Measurable CLOs

Measurable CLOs have the following characteristics:

- **Observable behavior**: The CLO describes a behavior that can be observed and evaluated.
- **Specific conditions**: The CLO specifies the conditions under which the behavior should be demonstrated (e.g., with or without references, using specific tools or resources).
- **Performance criteria**: The CLO indicates the criteria for acceptable performance (e.g., accuracy, speed, quality).

4.2 Strategies for Ensuring Measurability

To ensure that CLOs are measurable, consider the following strategies:

- **Use action verbs**: Begin each CLO with an action verb that describes an observable behavior.
- **Specify the object:** Clearly indicate what the student will act upon (e.g., a problem, a design, a system).
- **Include performance criteria**: When appropriate, specify the criteria for acceptable performance.
- **Consider assessment implications:** As you write each CLO, think about how you would assess student achievement of the outcome.

4.3 Examples of Non-Measurable and Measurable CLOs

Non-Measurable CLOs:

- "Students will understand fluid mechanics principles."
- "Students will appreciate the importance of sustainable design."

Measurable CLOs:

- "Students will be able to apply the principles of conservation of mass, momentum, and energy to solve fluid flow problems."
- "Students will be able to evaluate engineering designs based on sustainability criteria, including energy efficiency, material usage, and environmental impact."

5. CLO Development Process at FBSU

The development of CLOs for courses at FBSU follows a structured process (Figure 6) that ensures quality, consistency, and alignment with program goals:

5.1 Initial Development

- **Course coordinator drafts CLOs:** The course coordinator, in consultation with faculty who teach the course, drafts initial CLOs based on the course content, level, and position in the curriculum.
- **Review by department curriculum committee**: The department curriculum committee reviews the draft CLOs to ensure alignment with program goals, appropriate cognitive levels, and measurability.
- **Revision based on feedback:** The course coordinator revises the CLOs based on feedback from the curriculum committee.
- **Approval by department chair**: The department chair reviews and approves the final CLOs.

5.2 Periodic Review and Revision

- **Semester/Annual review:** CLOs are reviewed semi-annually/annually by the course coordinator and teaching faculty to ensure they remain relevant and effective.
- **Revision based on assessment results:** CLOs may be revised based on assessment results that indicate areas for improvement.
- **Revision due to curriculum changes:** CLOs are revised when there are significant changes to the course content, prerequisites, or program requirements.
- **Approval of revisions:** All revisions to CLOs must be approved by the department curriculum committee and chair.

5.3 Documentation

- **Course syllabus**: CLOs are included in the course syllabus distributed to students at the beginning of each semester.
- **Course specification**: CLOs are documented in the official course specification maintained by the department.
- **Curriculum map**: The relationship between CLOs and ABET Student Outcomes is documented in the program's curriculum map.

5.4 Number and Scope of CLOs

The number and scope of CLOs for a course should be appropriate to the course content, credit hours, and level. While there is no fixed rule for the number of CLOs, the following guidelines are recommended:

- **Typical range**: Most courses should have 3-8 CLOs.
- **Coverage**: CLOs should collectively cover the essential knowledge, skills, and behaviors that students should develop in the course.

- **Balance**: CLOs should include an appropriate mix of cognitive levels from Bloom's Taxonomy, with higher-level courses including more CLOs at the: analyze, evaluate, and create levels.
- **Manageability**: The number of CLOs should be manageable for both teaching and assessment purposes.

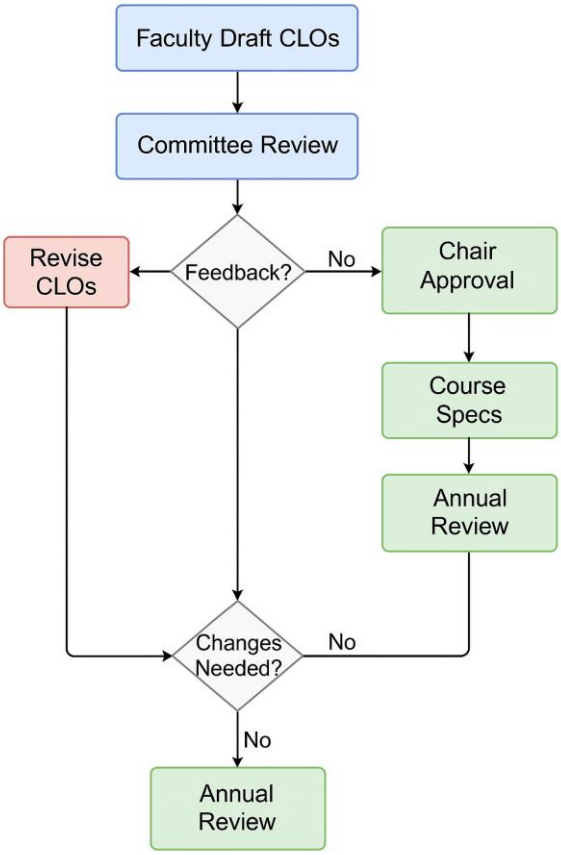


Figure 6: CLO Development Process

5.5 Examples of Well-Written CLOs for Engineering Courses at FBSU

The following examples demonstrate well-written CLOs for various engineering courses at FBSU. These examples incorporate the principles discussed in this section, including alignment with Student Outcomes, use of Bloom's Taxonomy, and emphasis on measurability and specificity.

5.5.1 Civil Engineering Course: Structural Analysis (CIVE 310)

Upon successful completion of this course, students will be able to:

1) Apply principles of statics to determine reactions and internal forces in statically determinate structures. (SLO 1)

2) Analyze statically determinate trusses, beams, and frames using appropriate methods. (SLO 1)
3) Calculate deflections in beams and frames using various methods including virtual work and moment-area theorems. (SLO 1)
4) Use structural analysis software to model and analyze complex structures. (SLO 1)

5.5.2 Electrical Engineering Course: Circuit Analysis (ELEE 210)

Upon successful completion of this course, students will be able to:

1) Apply Kirchhoff's laws, nodal analysis, and mesh analysis to solve DC and AC circuits. (SLO 1)
2) Analyze circuits containing operational amplifiers, diodes, and transistors. (SLO 1)
3) Calculate power, energy, and efficiency in electrical circuits. (SLO 1)
4) Design simple circuits to meet specified performance requirements. (SLO 2)
5) Write technical reports that document circuit analysis and experimental results. (SLO 3)

5.5.3 Mechanical Engineering Course: Thermodynamics

Upon successful completion of this course, students will be able to:

1) Apply the first and second laws of thermodynamics to analyze energy conversion systems. (SLO 1)
2) Calculate the efficiency of thermal cycles, including power cycles and refrigeration cycles. (SLO 1)
3) Design basic thermal systems to meet specified requirements with consideration of efficiency and environmental impact. (SLO 2, SLO 4)
4) Work effectively in teams to solve thermal engineering problems. (SLO 5)

6. Assessment of CLOs using the Assessment management system in FBSU.

The **Deanship of Engineering** developed a centralized system to automate assessment tracking, combining **direct** (e.g., exams, projects) and **indirect** (e.g., surveys) measures. All stakeholders (instructors, chairs, deans) access the system to ensure alignment with **NCAAA, ABET … etc., and program goals**.

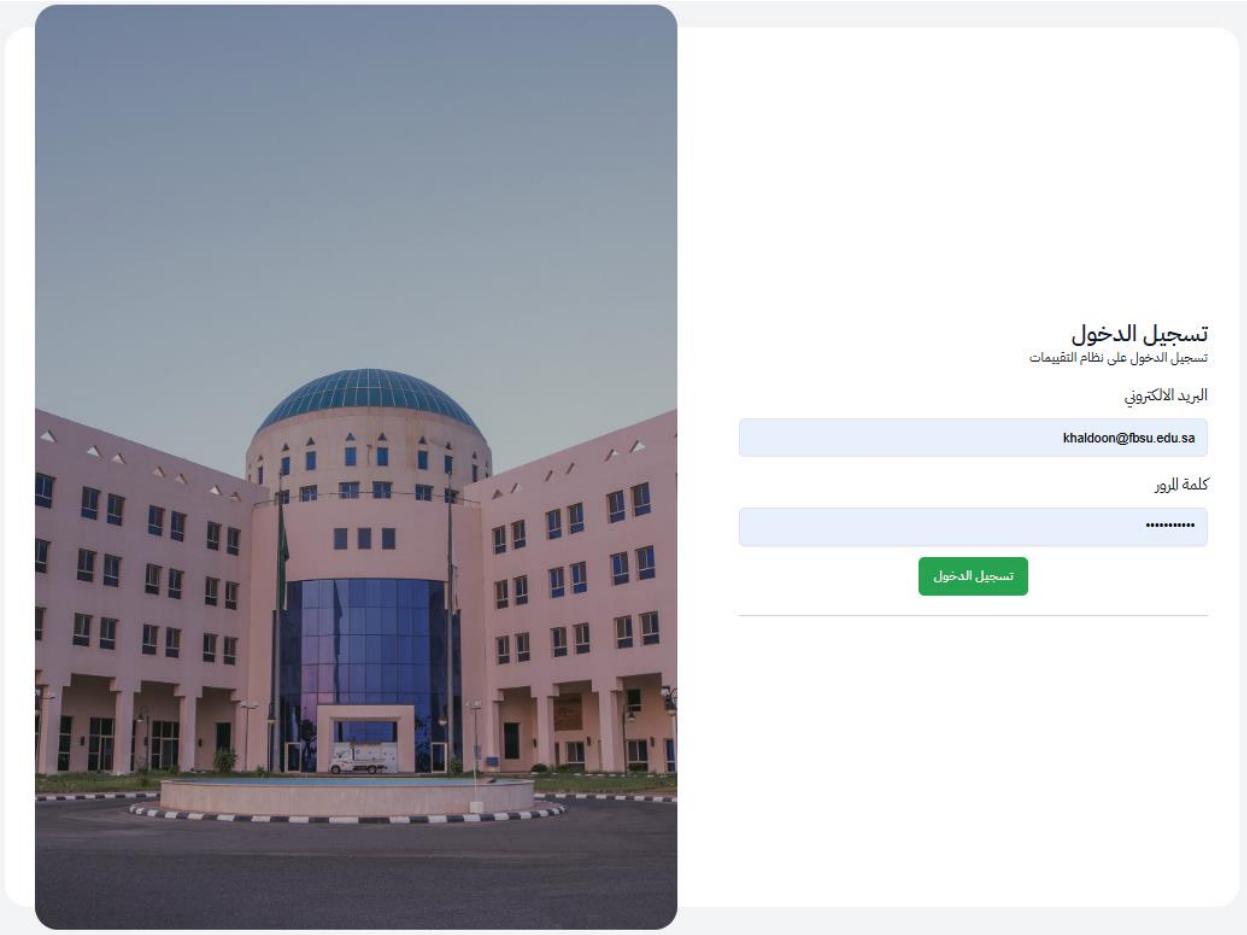


Figure 7: Quality Assurance management System

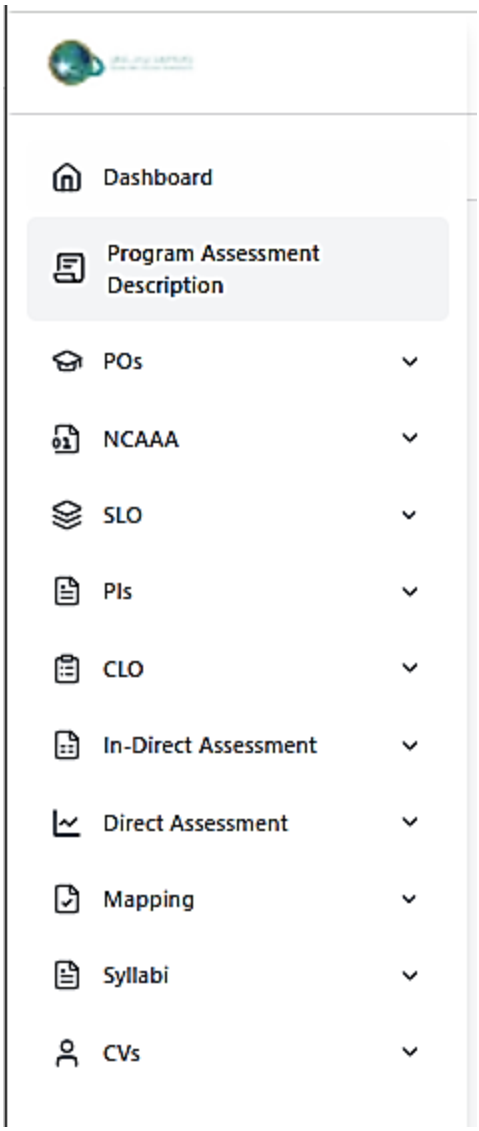


Figure 8: the Assessment management system front end

Step-by-Step Process

1. Program Chair Setup *(Initial Configuration)*

- **Input Required Data**:
  - Define **NCAAA-PLOs**, **SLOs**, and **Performance Indicators (PIs)**.
  - Map outcomes hierarchically:
    - POs ↔ Mission/Vision
    - POs ↔ Student Outcomes (PLOs/SLOs/PIs)
  - Set **weighted contributions**:

- Course weights for each **PI/PLO/SLO**.
- PI weights for SLOs, SLO weights for POs.

- **Output**: Automated mapping matrix for QA audits.

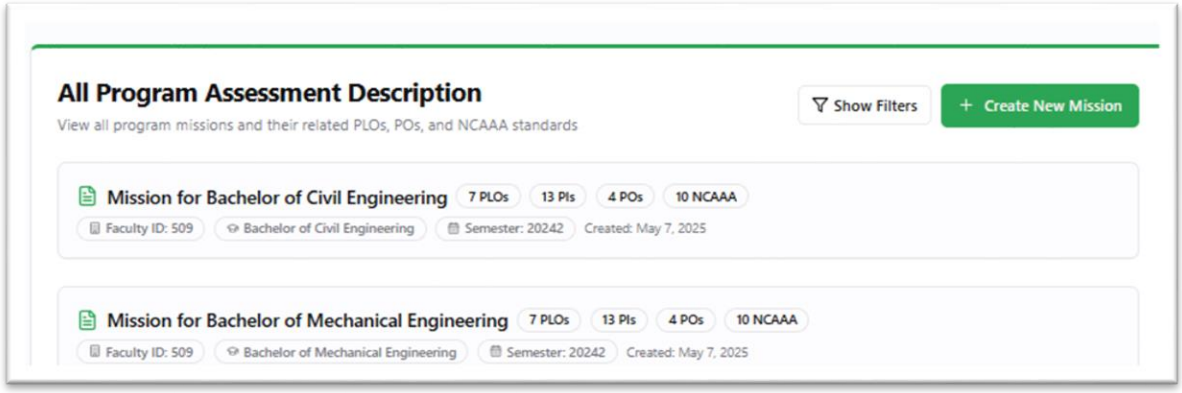


Figure 9: Assessment program mission and POs/ PLOs view

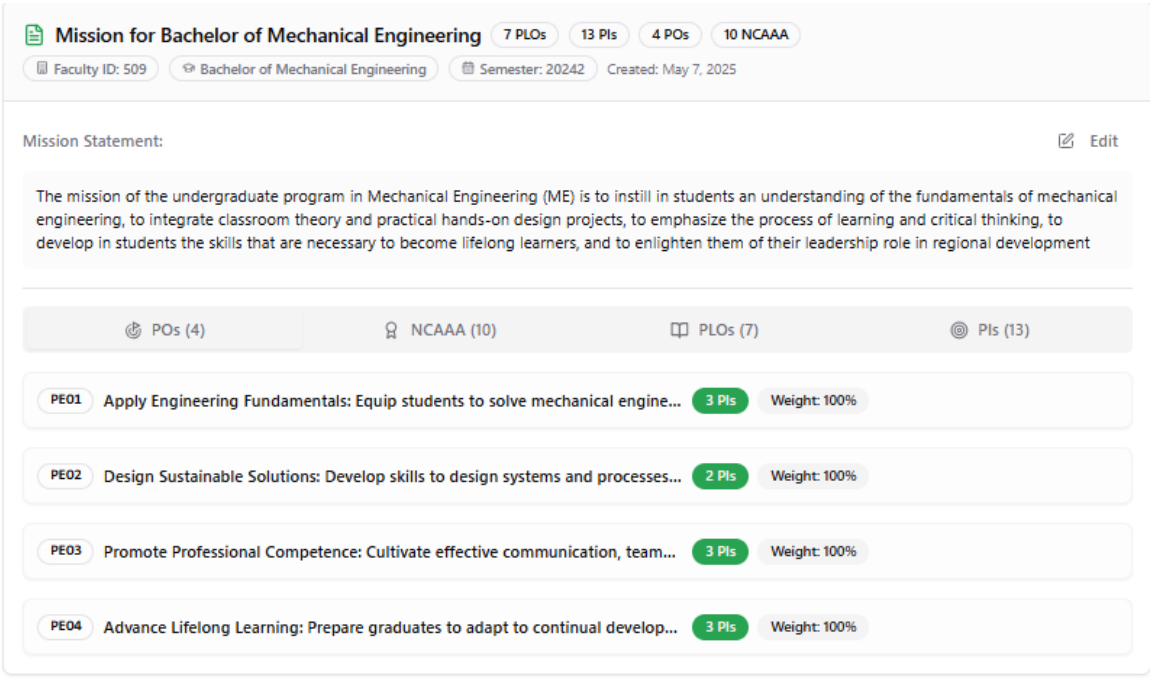


Figure 10: Program and POs/ PLOs / SLOs /PIs and relations view

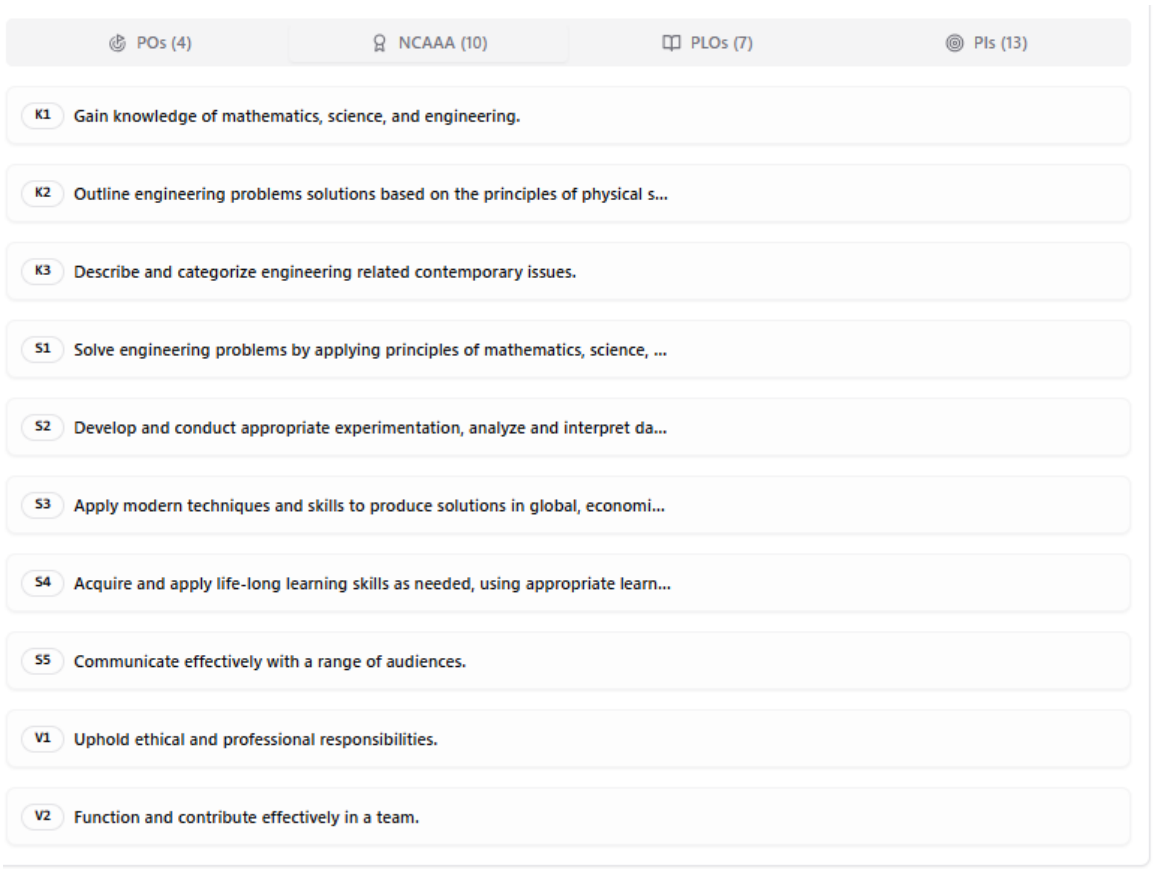


Figure 11: Program and POs/ PLOs / SLOs /PIs and relationships view

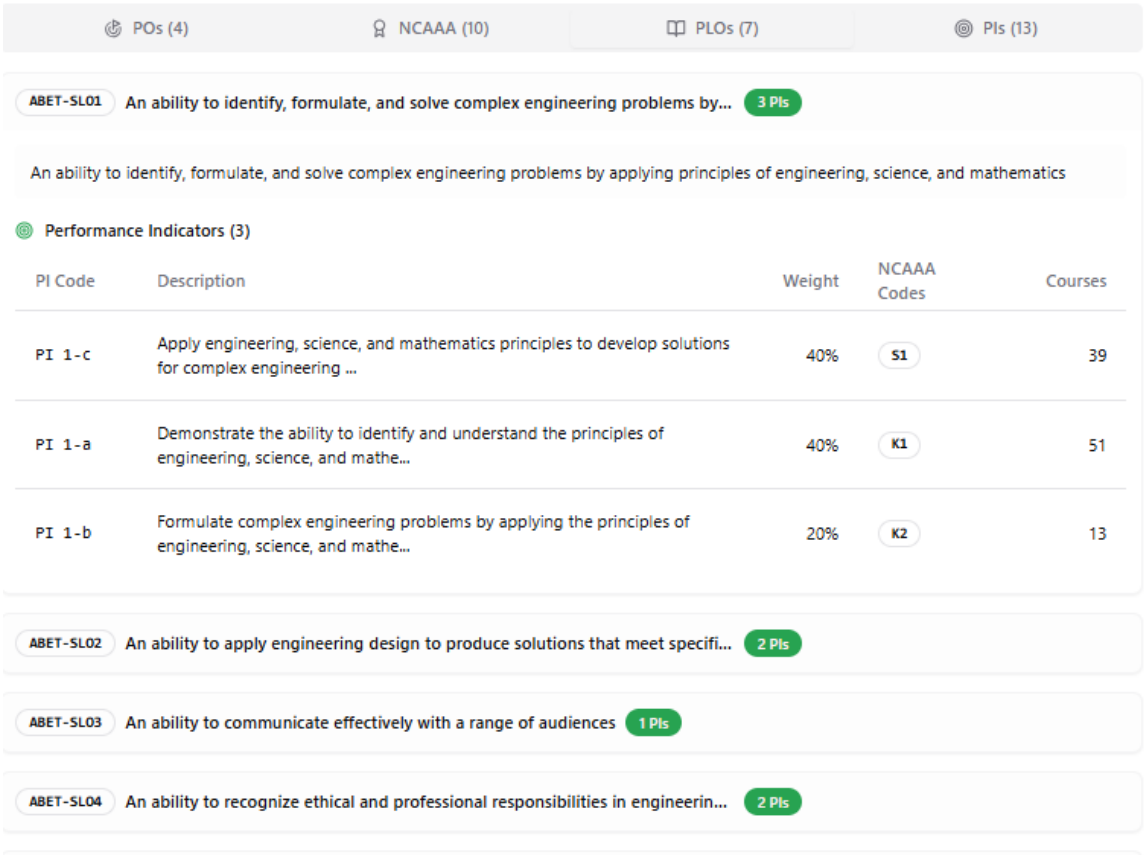


Figure 12: Program and POs/ PLOs / SLOs /PIs and relations view

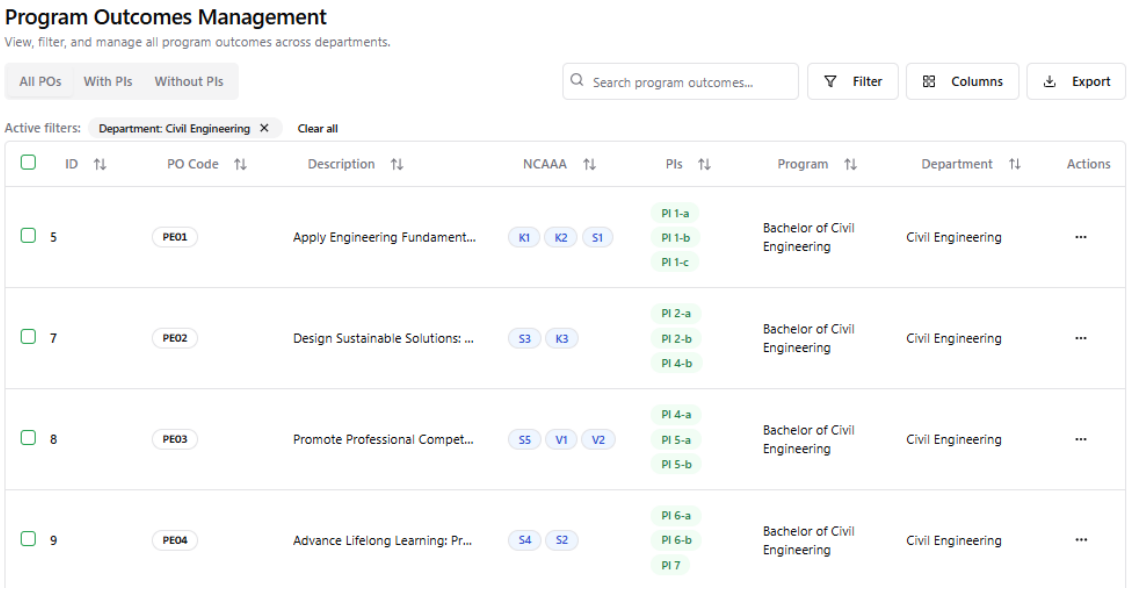
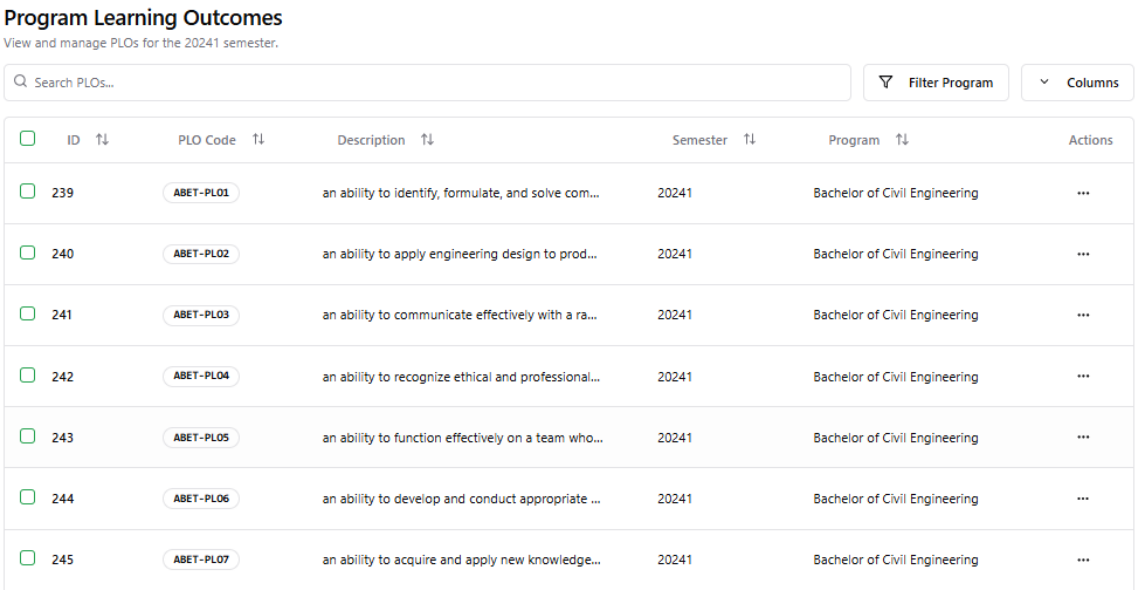


Figure 13: Program and PEOs creations and relations to program/student outcome



Program Learning Outcomes

View and manage PLOs for the 20241 semester.

Search PLOs... | Filter Program | Columns

ID	PLO Code	Description	Semester	Program	Actions
239	ABET-PLO1	an ability to identify, formulate, and solve com...	20241	Bachelor of Civil Engineering	...
240	ABET-PLO2	an ability to apply engineering design to prod...	20241	Bachelor of Civil Engineering	...
241	ABET-PLO3	an ability to communicate effectively with a ra...	20241	Bachelor of Civil Engineering	...
242	ABET-PLO4	an ability to recognize ethical and professional...	20241	Bachelor of Civil Engineering	...
243	ABET-PLO5	an ability to function effectively on a team who...	20241	Bachelor of Civil Engineering	...
244	ABET-PLO6	an ability to develop and conduct appropriate ...	20241	Bachelor of Civil Engineering	...
245	ABET-PLO7	an ability to acquire and apply new knowledge...	20241	Bachelor of Civil Engineering	...

Figure 14: Program and PLOs creations and relations to program PIs

PO Code	Mapping Matrix for PEO to PLOs/SLOs/PIs												
ABET	ABET-SLO1			ABET-SLO2		ABET-SLO3	ABET-SLO4		ABET-SLO5		ABET-SLO6		ABET-SLO7
PI	PI 1-a	PI 1-b	PI 1-c	PI 2-a	PI 2-b	PI 3	PI 4-a	PI 4-b	PI 5-a	PI 5-b	PI 6-a	PI 6-b	PI 7
NCAAA	K1	K2	S1	S3	S3	S5	V1	K3	V2	V2	S2	S2	S4
PEO1													
PEO2													
PEO3													
PEO4													

PO Code	Mapping Matrix for PEO to SLOs/PIs												
ABET	ABET-SLO1			ABET-SLO2		ABET-SLO3	ABET-SLO4		ABET-SLO5		ABET-SLO6		ABET-SLO7
PI	PI 1-a	PI 1-b	PI 1-c	PI 2-a	PI 2-b	PI 3	PI 4-a	PI 4-b	PI 5-a	PI 5-b	PI 6-a	PI 6-b	PI 7
PEO1	30	35	35										
PEO2				40	35			25					
PEO3						30	25		25	20			
PEO4											35	35	30

PO Code	Mapping Matrix for PEO to NCAAA-PLOs									
NCAAA	K1	K2	S1	S3	S5	V1	K3	V2	S2	S4
PEO1	30	35	35							
PEO2				75			25			
PEO3					30	25		45		
PEO4									70	30

Figure 15: Automatic generation of PEO mappings to the program/student outcome

Course Code	Course Name	Curriculum mapping to PLOs, SLOs, and PIs												
		ABET-SLO1			ABET-SLO2		ABET-SLO3	ABET-SLO4		ABET-SLO5		ABET-SLO6		ABET-SLO7
		PI 1-a	PI 1-b	PI 1-c	PI 2-a	PI 2-b	PI 3	PI 4-a	PI 4-b	PI 5-a	PI 5-b	PI 6-a	PI 6-b	PI 7
		K1	K2	S1	S3		S5	V1	K3	V2		S2		S4
CHEM 101	General Chemistry	100	100	100										
MATH 100	Mathematics I	100	100	100										
MATH 201	Calculus and Analytic Geometry III	100		100										
MATH 215	Linear Algebra and Numerical Techniques	100	100	100										
MATH 102	Calculus II	100	100	100										
MATH 202	Differential Equations	100	100	100										
MATH 101	Calculus I	100	100	100										
PHYS 101	General Physics I	100		100										
PHYS 102	General Physics II	100		100										
CSC 101	Introduction to Computing for Engineers	100					70							
STAT 230	Probability and Statistics	100	100	100										
CIVE 205	Engineering Drawing	100								70	70			
CIVE 210	Statics	100		100										
CIVE 211	Structural Mechanics	100		100										
CIVE 215	Computer Aided Engineering	100					70							
CIVE 220	Engineering Materials	100			100									
CIVE 240	Fluid Mechanics	100		100										
CIVE 250	Environmental Engineering	100			90	70								
CIVE 260	Spatial Measurements	100												
CIVE 310	Structural Analysis I	100		100										
CIVE 320	Concrete I	100		100										
CIVE 330	Geotechnical Engineering	100												
CIVE 351	Water and Wastewater Treatment and Labora	100			100	70								
CIVE 360	Transportation Engineering	100		100										
CIVE 412	Steel Design	100		100										
CIVE 430	Foundation Engineering	100	100	100										
CIVE 460	Highway Engineering	100		100										
CIVE 471	Quantity Surveying and Cost Estimation	100		100										
CIVE 480	Construction Management	100		100		100								
CIVE 461	Pavement Design	100		100	100									
PHYS 103L	Physics Lab	100								100		100		
CIVE 472	Contracts and Specifications	100				100			100					
ELEE 230	Programming for Engineers		100	100									70	
CIVE 400	Summer Internship for Civil Students		100				100	100	100	100	100			100
CIVE 498	Final Year Project I		100		100	100	100	100	100	100	100	100	100	
COEN 300	Engineering Economy		100		90				100					
CIVE 410	Structural Analysis II		100	100										
CIVE 499	Final Year Project II				100	100	100	100	100	100	100	100	100	
ARAB 101	Basic Academic Arabic						100							
ARAB 201	Advanced Academic Arabic						100							
ENGL 100	General English						100			100				
ENGL 101	Basic Academic English I						100			100				
ENGL 102	Basic Academic English II						100			100				
ENGL 203	Advanced Academic English I						100			100				
ENGL 206	Technical Writing						100			100				
SOCS 101	Islamic Civilization I						80			70				
SOCS 201	Islamic Civilizations II						80			70				
COEN 401	Communication skills and Ethics						70	100	70					
SOCS 202	World Civilizations						70			70				
CIVE 220L	Engineering Materials Lab									100		100	100	
CIVE 240L	Fluid Lab									100		100	100	
CIVE 260L	Surveying Lab									100		100	100	
CIVE 330L	Geotechnical Engineering Lab									100		100	100	
CHEM 101L	General Chemistry Lab									100		100		

Figure 16: Automatic generation of PLO/SLO/PI mappings to the program curriculum

2. User Access & Data Query *(Transparency)*

- **Stakeholders** (instructors/chairs/deans) can:
  - View **real-time mappings** (e.g., course-to-PLO alignment).
  - Track **program quality metrics** (e.g., PLO achievement rates).
  - Generate reports for accreditation (e.g., ABET, NCAAA).

3. Instructor Syllabus Preparation *(Alignment)*

- Design syllabi using **predefined weights/mappings** from the system.

- Ensure CLOs reflect:
    - Course-level contributions to PIs/SLOs.
    - Bloom's Taxonomy levels (e.g., "Analyze" for senior courses).

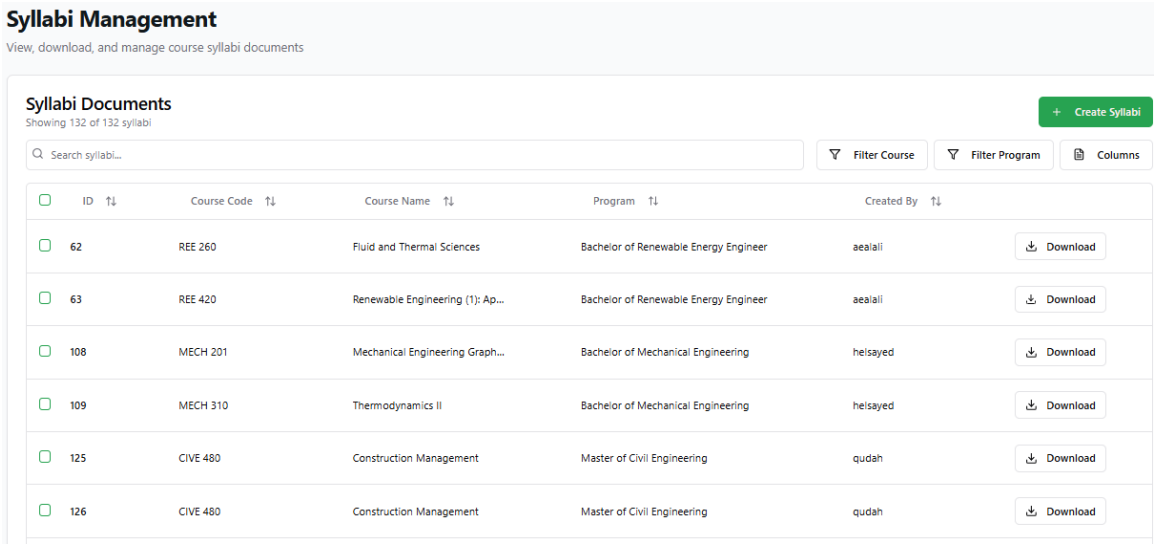


Figure 17: Syllabi Generation page

FAHAD BIN SULTAN UNIVERSITY
COLLEGE OF ENGINEERING
RENEWABLE ENERGY ENGINEERING DEPARTMENT

ELEE 212: Circuits for Non-electrical Students

Spring 2024-2025

Catalogue Description

(3 credit hours) [A course on fundamentals of electric circuits, basic elements and laws, techniques of circuit analysis; Circuit Theorems, AC Circuit Analysis, Three Phase Circuits; Transformers].

Prerequisite(s): PHYS 102-General Physics II

Textbook

Fundamentals of Electric Circuits, 5th Edition, Charles K. Alexander and Matthew N.O. Sadiku, McGraw-Hill, 2013.

Reference(s)

Electric Circuits, 11th Edition, James W. Nilsson and Susan A. Riedel, Pearson, Pearson, 2018.

Engineering Circuit Analysis, 8th edition, William H. Hayt, Jack Kemmerly, Steven M. Durbin, McGraw-Hill Education, 2011.

Instructor

Dr. Ammar Alkahtani
Office: S-3036, Ext. 1153
e-mail: aalkahtani@fbsu.edu.sa
Office hours: Su, Tu, Thu: 8:00-10:00,12:00:13:00, Mo, Wed: 10:00-12:30

Course Topics

Week	Topic	Chapter(s) in textbook
1	Circuit Basic Concept	1
2-3	Basic Laws	2
4-5	Techniques of Circuit Analysis	3
6,7	Nodal and Mesh analysis	4
8,9	Circuit theorems and RLC Circuits	4,7
10	Inductors and Capacitors	6
11	Introduction to AC Circuits.	9-10
12-13	Three-phase circuits and AC power analysis	11,12
14	Transformers	13

Grading Policy

Attendance and Participation:	5%
Assignments:	15%
Exam 1	15 %
Exam 2	15%
Quizzes	10 %
Final Exam:	40%

Course Objectives

1) Realize the basics of current-voltage division and series-parallel resistance connections.
2) Understand and apply methods of circuit analysis and circuit theorems.
3) Recognize and analyze AC circuits.
4) Analyze three-phase circuits and transformers.

Figure 18: Downloaded Syllabus form the system Page 1

FAHAD BIN SULTAN UNIVERSITY
COLLEGE OF ENGINEERING
RENEWABLE ENERGY ENGINEERING DEPARTMENT

Course Learning Outcomes (CLOs)

		CLOs
CLO#	1	**Knowledge and Understanding**
CLO1	1.1	Understand the fundamentals of circuit theory
CLO2	1.2	Understand and explain different methods for analyzing and solving AC and DC circuits
	2	**Skills :**
CLO3	2.1	Analyze and evaluate circuit analysis methods and theorems in both AC and DC circuits.
CLO4	2.2	Calculate equivalent elements, voltage, and current for capacitors and inductors.
CLO5	2.3	Analyze three-phase electrical circuits and transformers
	3	**Values :**
	3.1	NA

Relationship to the Bachelor of Renewable Energy Engineering Program (ABET SLOs, PIs, NCAAA PLOs)

Mapping Matrix Weights

ABET SLOs and PIs	1			2		3	4		5		6		7
	1a	1b	1c	2a	2b	3	4a	4b	5a	5b	6a	6b	7
PIs-Weight (%)	25	35	40	55	45	100	55	45	60	40	55	45	100
NCAAA PLOs	K1	K2	S1	S3		S5	V1	K3	V2		S2		S4
Course Contribution %	70	90	100										

Relationship to the Bachelor of Renewable Energy Engineering Program (NCAAA PLOs, NQF)

Mapping Matrix Weights

NCAAA PLOs	K1	K2	K3	S1	S2	S3	S4	S5	V1	V2
NQF-Weight (%)	30	35	35	30	25	20	15	10	55	45
Course Contribution %	70	90	100							
Competency Scale	I	P	P							

Contribution of Course to Meeting the Professional Component

The course contributes to building the fundamental basic concepts, applications, design ,and analysis of electric circuits.

Relationship to the Bachelor of Renewable Energy Engineering Program Outcomes

ABET SOs	1					2		3	4		5		6		7
PIs	1a	1b	1c			2a	2b	3	4a	4b	5a	5b	6a	6b	7
NCAAA PLOs	K1	K2	S1			S3		S5	V1	K3	V2		S2		S4
CLOs	1	2	3	4	5										
CLOs-Weight (%)	100	100	40	20	40										

Relationship to the Renewable Energy Engineering Program Objectives (POs)

I	II	III	IV
✓	✓		✓

Figure 19: Downloaded Syllabus form the system Page 2 with mapping CLOs to student outcome

4. CLO Generation *(Consistency)*

- Instructors derive CLOs from:
    - **Course-to-PI mappings** (entered by the chair).
    - **Program-level outcomes** (e.g., SLO3: Communication Skills).
- *Example*: A course contributing to **PI3 (Technical Design)** might include CLOs like:

"Design civil engineering systems using industry-standard tools (PI3, SLO5)."

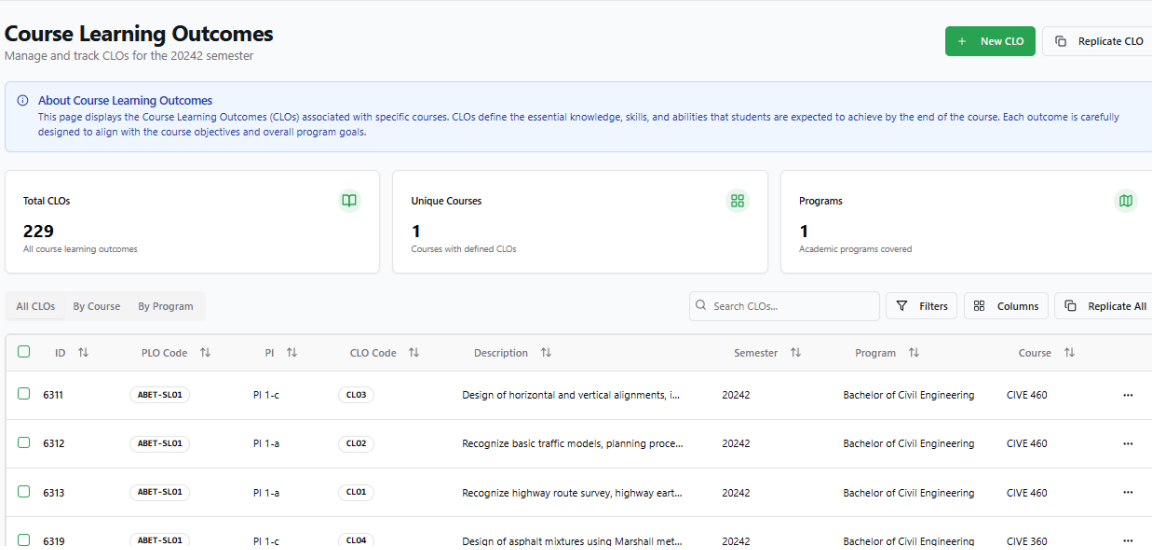


Figure 20: Design the CLOs for each course by instructors

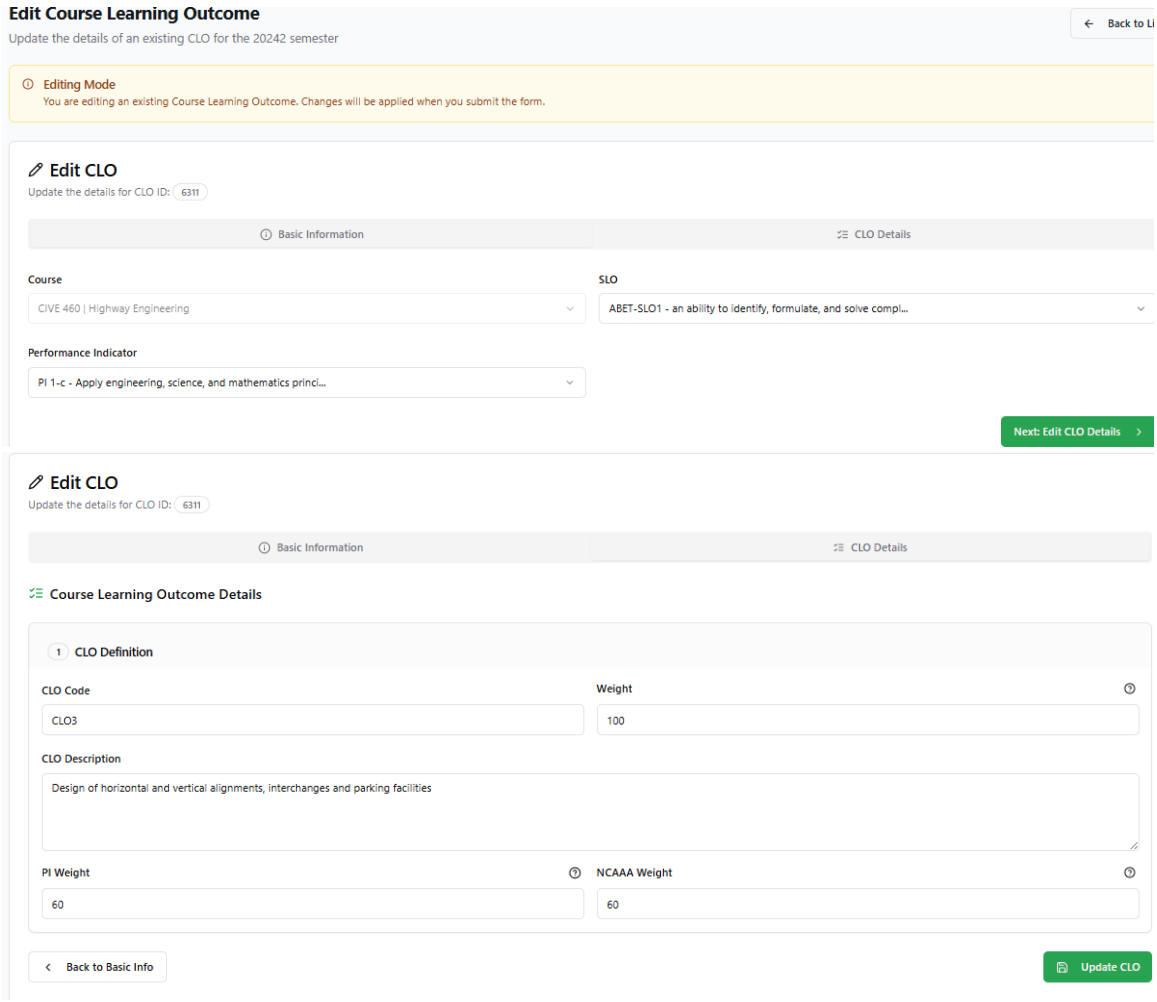


Figure 21: Entering the CLOs and editing them

5. Assessment Tool Selection *(Measurability)*

- Instructors must:
    - Specify **assessment tools** (e.g., rubrics, exams, portfolios).
    - Align tools with CLOs (e.g., project-based assessments for "Design" CLOs).
    - Enter **target thresholds** (e.g., 65%/70% mastery for "Satisfactory").

6. Direct Assessment (Instructor)

- **Tool Selection**: Instructor chooses methods (e.g., rubrics, exams) for each CLO via the system.
- **CLO Setup**: Define tools, deadlines, and performance criteria.
- **Evidence-Based Evaluation**:

- System auto-generates student lists per assessment.
- Instructor inputs scores and **uploads proof** (e.g., scanned exams, project files).

- **Moderation & Approval**:
  - Moderator reviews submissions (approve/reject/modify with comments).
  - Chair conducts final verification.

7. Indirect Assessment (Surveys)

- **Student Surveys**: Instructor designs end-of-semester surveys (e.g., self-efficacy, course feedback).
- **Automated Storage**: Results saved in the system for analysis.

8. System Automation

- **Weighted Averages**: System computes:
  - **Direct**: Scores from exams/projects (weighted by CLO/course contributions).
  - **Indirect**: Survey responses (e.g., 80% direct + 20% indirect).
- **Reports**: Semester-wise summaries for QA/ABET/NCAAA.

9. Stakeholder Surveys (Chair)

- **Target Groups**: Alumni, employers, advisory boards.
- **Process**:
  - Chair sends survey links via the system.
  - System anonymizes and aggregates data.
  - Generates **benchmarking reports** (e.g., industry satisfaction with graduates).

10. Data Aggregation

- **Inputs**:
  - Direct assessment results (course-by-course).
  - Indirect survey averages.
  - Stakeholder survey summaries.
- **Output**: Single spreadsheet with:

Course Code	CLO	Achieved %	Target %	Status (✓/✗)	Evidence Link
CIVE 401	1.2	82%	65%	✓	[View]
COEN 320	3.1	60%	65%	✗	[View]

11. Automated Features

- **Threshold Checking**:
  - **Green** (Met Target) | **Red** (Below Target).
- **Drill-Down Links**: Click to view evidence (e.g., rubrics, exam samples).
- **Export Options**: PDF/Excel for accreditation dossiers.

12. Alerts & Actions

- **Auto-Notify** program chairs if:
  - 30% of CLOs in a course miss targets.
  - Indirect surveys show consistent dissatisfaction.
- **Trigger Review**: Flagged courses require improvement plans.

---

13. End of Semester: System compiles all course data.

Example Workflow

Summary Sheet:

- Shows **ENGL 101** achieved 88% (Target: 65%) for CLO2 (Design Skills).
- Flags **MATH 201** CLO3 (Analysis) at 62% (Target: 65%).

Chair Receives:

- Email alert for MATH 201.
- Link to evidence (e.g., low exam scores).

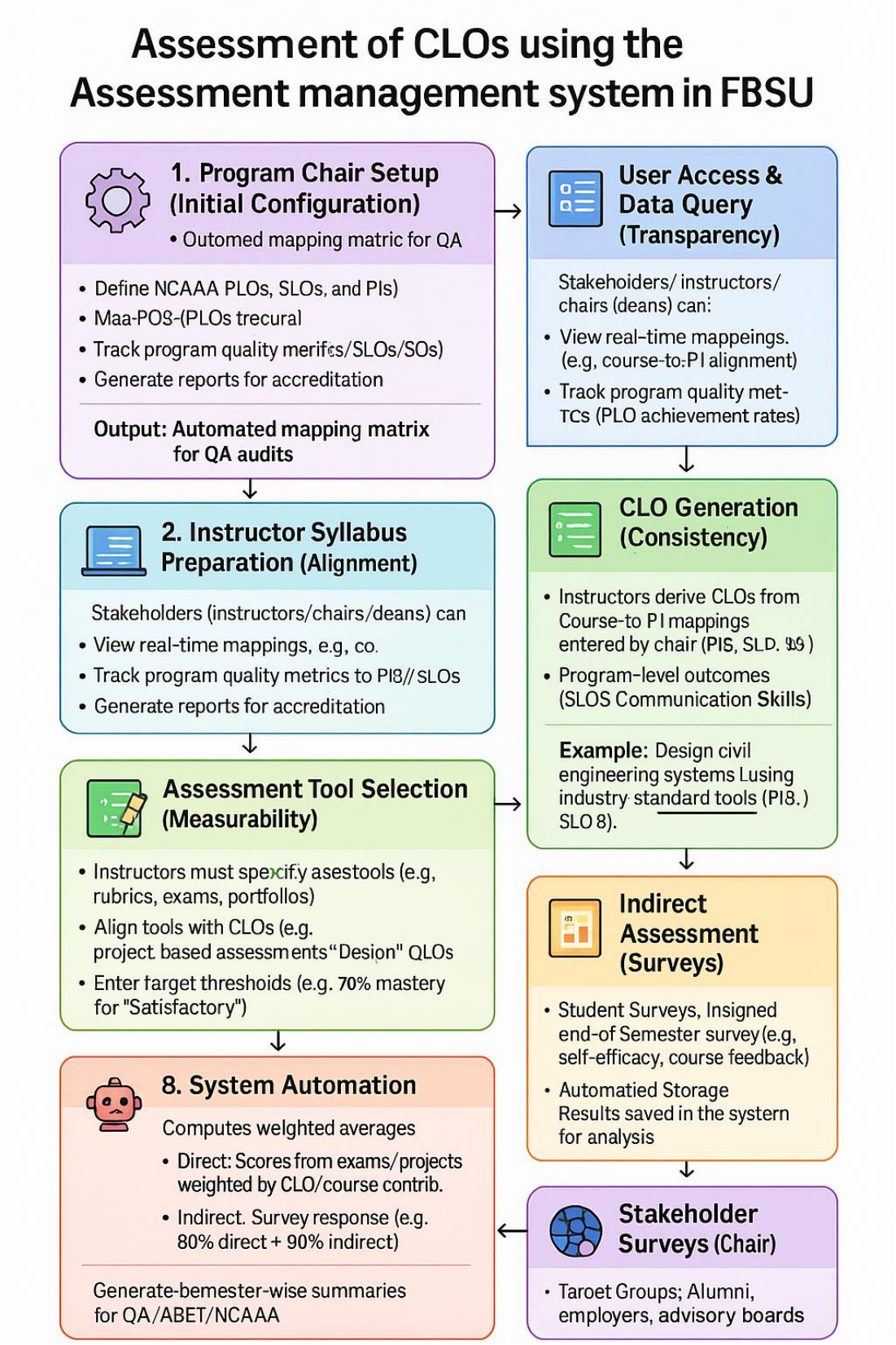


Figure 22: CLOs assessment using QA management system

7. Conclusion

The development of effective Course Learning Outcomes is a critical step in creating a high-quality engineering education program that meets national and international accreditation requirements. By following the principles and processes outlined in this section, faculty at FBSU can create CLOs that clearly communicate expectations to students, guide teaching and assessment activities, and contribute to the achievement of program-level outcomes.

Well-designed CLOs that align with Student Outcomes provide the foundation for a coherent and effective curriculum that prepares students for successful professional practice in engineering. Regular review and refinement of CLOs based on assessment results and feedback from stakeholders ensure that the curriculum remains relevant and effective in meeting the needs of students and the engineering profession.

Section IV

Assessment Methods and Tools

1. Direct Assessment Methods

Direct assessment methods measure student learning by requiring students to demonstrate their knowledge, skills, and abilities directly. These methods provide tangible evidence of student achievement of Course Learning Outcomes (CLOs) and are essential components of a comprehensive assessment system aligned with ABET requirements.

1.1 Exams and Quizzes

Exams and quizzes are traditional assessment tools that can effectively measure student knowledge and understanding. When properly designed, they can assess various levels of cognitive skills from basic recall to complex problem-solving.

1.1.1 Types of Exams and Quizzes for Engineering Courses:

- **Multiple-choice questions**: Useful for assessing knowledge recall, basic understanding, and application of concepts. They can be designed to test higher-order thinking skills if carefully constructed.
- **Short-answer questions**: Require students to provide brief responses that demonstrate understanding and application of engineering concepts.
- **Problem-solving questions**: Require students to apply principles and methods to solve engineering problems, demonstrating their analytical and computational skills.
- **Essay questions**: Allow students to demonstrate deeper understanding, analysis, evaluation, and synthesis of engineering concepts.
- **Conceptual questions**: Assess students' understanding of fundamental principles and theories without extensive calculations.

1.1.2 Best Practices for Using Exams and Quizzes in Engineering Assessment:

- Align questions with specific CLOs to ensure that the assessment measures the intended outcomes
- Include questions at various levels of Bloom's Taxonomy to assess different cognitive skills
- Provide clear instructions and expectations for each question
- Use a variety of question types to accommodate different learning styles
- Develop and use rubrics for consistent grading of subjective questions
- Analyze exam results to identify areas where students are struggling and adjust teaching accordingly
- Include questions that assess students' ability to apply ABET Student Outcomes

1.1.3 Example Exam Question Aligned with Student Outcomes:

Civil Engineering (Aligns with SLO 1: Problem Solving)

"*A simply supported beam of length 6m carries a uniformly distributed load of 20 kN/m. Calculate the maximum bending moment and deflection in the beam. The beam has a modulus of elasticity E = 200 GPa and moment of inertia I = 4 × 10^-4 m^4.*"

Electrical Engineering (Aligns with SLO 2: Design)

"*Design a two-stage amplifier circuit that provides a voltage gain of at least 100 and an input impedance of at least 10 kΩ. Specify all component values, draw the complete circuit, and explain your design choices*."

Mechanical Engineering (Aligns with SLO 6: Experimentation)

"*An experiment was conducted to determine the coefficient of friction between two materials. The data collected is shown in the table below. Analyze the data, calculate the coefficient of friction with its uncertainty, and discuss potential sources of experimental error*."

1.2 Projects and Assignments

Projects and assignments provide opportunities for students to apply knowledge and skills to realistic problems over an extended period. They are particularly effective for assessing higher-order thinking skills, creativity, and integration of knowledge.

1.2.1 Types of Projects and Assignments for Engineering Assessment:

- **Design projects**: Require students to design solutions to engineering problems, demonstrating their ability to apply engineering principles, consider constraints, and meet specifications.
- **Research papers**: Require students to investigate a topic, analyze information, and present findings in a structured format.
- **Case studies**: Require students to analyze real-world engineering situations, identify problems, and propose solutions.
- **Problem sets**: Consist of a series of problems that require application of specific concepts or methods.
- **Programming assignments**: Require students to develop software to solve engineering problems, demonstrating their computational skills.
- **Simulation exercises**: Require students to use simulation software to model and analyze engineering systems.

1.2.2 Best Practices for Using Projects and Assignments in Engineering Assessment:

- Provide clear project descriptions, including objectives, requirements, and evaluation criteria
- Break large projects into manageable components with intermediate deadlines

- Develop and use rubrics that align with CLOs and ABET Student Outcomes for consistent evaluation
- Provide opportunities for feedback and revision during the project
- Include both individual and team projects to assess different skills
- Design projects that integrate multiple concepts and skills from the course
- Incorporate real-world constraints and considerations into project requirements

1.2.3 Example Project Assignment Aligned with Student Outcomes:

Civil Engineering (Aligns with SLO 2: Design, SLO 3: Communication, SLO 4: Ethics, SLO 5: Teamwork)

"*Working in teams of 4, design a pedestrian bridge for a university campus that spans a 30m creek. The design must consider accessibility, safety, aesthetics, environmental impact, and cost. Prepare a comprehensive design report and give a presentation to the class. Include a section addressing the ethical considerations of your design*."

Electrical Engineering (Aligns with SLO 1: Problem Solving, SLO 6: Experimentation, SLO 7: Lifelong Learning)

"*Design and implement a microcontroller-based system that monitors and controls room temperature. Research current technologies, select appropriate sensors and actuators, develop the control algorithm, and build a working prototype. Document your design process, implementation, and test results in a technical report*."

Mechanical Engineering (Aligns with SLO 2: Design, SLO 4: Ethics, SLO 5: Teamwork)

"*Design an energy-efficient HVAC system for a small office building. Working in teams, determine heating and cooling loads, select appropriate equipment, design the distribution system, and estimate energy consumption and operating costs. Consider environmental impact and sustainability in your design. Present your design in a technical report and oral presentation*."

Renewable Energy Engineering (Aligns with SLO 1: Problem Solving, SLO 2: Design, SLO 3: Communication, SLO 4: Ethics, SLO 5: Teamwork, SLO 7: Sustainability & Context)

Project Title: Community-Based Solar Power System Design

"*Working in teams of 3–5, design a small-scale solar photovoltaic (PV) energy system to supply electricity to a remote village school. Your design should account for energy demand, solar irradiance, battery storage, system efficiency, cost constraints, environmental impact, and long-term sustainability. Develop a detailed technical report, including energy yield analysis, system sizing, component selection, and lifecycle cost estimation. Present your project in a professional format, including a 10-minute team presentation to a mock panel of stakeholders.*

Be sure to include a section discussing the ethical and social responsibility of deploying renewable technologies in underdeveloped areas, and how your solution contributes to sustainability and the UN SDGs (Sustainable Development Goals)."

1.3 Laboratory Reports and Practical Assessments

Laboratory experiences are essential components of engineering education, providing opportunities for hands-on application of theoretical concepts. Laboratory reports and practical assessments evaluate students' ability to conduct experiments, analyze data, and draw conclusions.

1.3.1 Components of Laboratory Reports for Engineering Assessment:

Introduction: States the purpose and objectives of the experiment, including relevant theoretical background.

Methodology: Describes the experimental setup, procedures, and equipment used.

Results: Presents the data collected during the experiment, often using tables, graphs, and charts.

Analysis: Interprets the results, including calculations, statistical analysis, and error analysis.

Discussion: Relates the results to theoretical concepts, explains discrepancies, and discusses implications.

Conclusion: Summarizes the findings and their significance.

References: Lists sources cited in the report.

1.3.2 Best Practices for Using Laboratory Reports in Engineering Assessment:

- Align laboratory experiments with specific CLOs and Student Outcomes
- Provide clear guidelines for report structure and content
- Develop and use rubrics that assess both technical content and communication skills
- Require error analysis and discussion of limitations
- Include questions that prompt students to relate experimental results to theoretical concepts
- Provide timely feedback on reports to guide improvement
- Assess safety awareness and proper laboratory procedures

1.3.3 Example Laboratory Assessment Aligned with Student Outcomes:

Civil Engineering (Aligns with SLO 6: Experimentation)

"*Conduct a series of tests to determine the compressive strength of concrete cylinders with different water-cement ratios. Analyze the relationship between water-cement ratio and strength. Discuss the implications for concrete mix design in structural applications*."

Electrical Engineering (Aligns with SLO 1: Problem Solving, SLO 6: Experimentation)

"*Design and conduct an experiment to characterize the frequency response of an RLC circuit. Compare the experimental results with theoretical predictions. Analyze sources of error and discuss the limitations of your measurement techniques*."

Mechanical Engineering (Aligns with SO 6: Experimentation)

"*Conduct an experiment to determine the coefficient of performance of a refrigeration system under various operating conditions. Analyze the data to determine the relationship between operating parameters and system efficiency. Compare your results with theoretical predictions*."

Renewable Energy Engineering :(Aligns with SLO 1: Problem Solving, SLO 6: Experimentation)

"*Conduct an experiment to measure the performance of a photovoltaic (PV) panel under varying irradiance and temperature conditions. Collect data on voltage, current, and power output at different times of the day and under simulated shading conditions. Analyze the effect of these variables on panel efficiency and compare your experimental results with manufacturer specifications and theoretical models. Discuss the sources of error, limitations of the measurement setup, and implications for real-world solar energy system design and deployment*."

1.4 Capstone Projects

Capstone projects are culminating experiences that require students to integrate and apply knowledge and skills acquired throughout their program. They are particularly valuable for assessing program-level outcomes and students' readiness for professional practice.

1.4.1 Characteristics of Capstone Projects for Engineering Assessment:

Comprehensive: Require integration of knowledge and skills from multiple courses.

Authentic: Address realistic engineering problems, often in collaboration with industry partners.

Open-ended: Involve design decisions, trade-offs, and consideration of multiple constraints.

Team-based: Typically involve collaboration among students with different skills and perspectives.

Multi-stage: Include planning, design, implementation, testing, and documentation phases.

Interdisciplinary: Often require consideration of technical, economic, social, and environmental factors.

1.4.2 Best Practices for Using Capstone Projects in Engineering Assessment:

- Define clear project objectives that align with Student Outcomes
- Establish a structured process with defined milestones and deliverables
- Develop comprehensive rubrics that assess technical, professional, and interpersonal skills
- Include multiple assessment points throughout the project
- Incorporate feedback from industry partners or external reviewers
- Require formal presentations and documentation of the project. Use capstone projects as a key component of program-level assessment

1.4.3 Example Capstone Project Aligned with Student Outcomes:

Civil Engineering (Aligns with all Student Outcomes)

"*Design a sustainable residential development for a 10-hectare site, including infrastructure (roads, water supply, sewerage, and storm water management) and consideration of environmental, social, and economic factors. Work with a multidisciplinary team to develop a comprehensive design that meets all applicable codes and standards. Present your design to a panel of faculty and industry representatives*."

Electrical Engineering (Aligns with all Student Outcomes)

"*Design and implement a smart home automation system that integrates security, energy management, and comfort control. The system should be user-friendly, cost-effective, and energy-efficient. Develop a working prototype, test its performance, and document the design process and results. Present your project to faculty and industry representatives*."

Mechanical Engineering (Aligns with all Student Outcomes)

"*Design and build a solar-powered water pumping system for agricultural use in remote areas. The system should be reliable, maintainable, and cost-effective. Consider environmental, social, and economic factors in your design. Test the system's performance under various conditions and document the results. Present your project to faculty and industry representatives*."

Renewable Energy Engineering: (Aligns with all Student Outcomes)

"*Design and develop a hybrid renewable energy system to supply reliable and sustainable power to an off-grid rural community. The system should integrate solar photovoltaic, wind, and battery storage technologies, and consider site-specific resource availability, load demand, economic feasibility, and environmental impact. Collaborate in a multidisciplinary team to model system performance, optimize component sizing, and ensure compliance with safety and regulatory standards. Build a scaled-down prototype or simulation model, test its functionality, and prepare a comprehensive technical report and presentation for a panel of faculty and industry professionals*."

1.5 Rubrics for Direct Assessment

Rubrics are scoring tools that explicitly describe the expectations for an assignment or project. They provide a framework for consistent evaluation of student work and clear communication of expectations to students.

1.5.1 Types of Rubrics for Engineering Assessment:

- **Analytic rubrics**: Break down the assessment into specific criteria, with detailed descriptions of performance levels for each criterion. They provide detailed feedback on strengths and weaknesses.
- **Holistic rubrics**: Provide an overall description of performance at each level without breaking it down into separate criteria. They are useful for quick assessments of overall quality.
- **Single-point rubrics**: Describe only the proficient level of performance for each criterion, with space for noting areas of concern and excellence. They focus attention on areas needing improvement.

1.5.2 Components of an Effective Rubric for Engineering Assessment:

- **Criteria**: The aspects of the work being evaluated, aligned with CLOs and ABET Student Outcomes.
- **Performance levels**: Descriptions of different levels of achievement for each criterion, typically ranging from excellent to unsatisfactory.
- **Descriptors**: Clear, specific descriptions of what constitutes each performance level for each criterion.
- **Scoring**: Point values or weights assigned to each criterion and performance level.

1.5.3 Example Rubric for Engineering Design Project:

Table 2: Example Rubric for Engineering Design Project

Criterion	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Problem Definition (SLO 1)	Clearly defines the problem, including all relevant constraints and criteria.	Defines the problem with most constraints and criteria identified.	Basic problem definition with some constraints and criteria identified.	Incomplete problem definition with few constraints and criteria identified.

Criterion	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Design Concept (SLO 2)	Develops innovative design concepts that fully address the problem. Considers multiple alternatives and justifies selection.	Develops effective design concepts that address the problem. Considers some alternatives and provides rationale	Develops basic design concepts that partially address the problem. Limited consideration of alternatives.	Develops incomplete or inappropriate design concepts that do not adequately address the problem. No consideration of alternatives.
Technical Analysis (SLO 1)	Comprehensive analysis using appropriate engineering principles. Calculations are correct and thoroughly documented.	Good analysis using appropriate engineering principles. Calculations are mostly correct.	Basic analysis with some application of engineering principles. Some errors in calculations.	Inadequate analysis with limited application of engineering principles. Significant errors
Consideration of Constraints (SLO 2, SLO 4)	Thoroughly considers all relevant constraints (economic, environmental, social, ethical, health and safety, sustainability).	Considers most relevant constraints with good depth of analysis.	Considers some constraints with basic analysis.	Minimal consideration of constraints.
Communication (SLO 3)	Clear, concise, and professional communication. Well-organized with excellent graphics and proper technical language.	Good communication with minor issues in organization or clarity. Good graphics and appropriate technical language.	Basic communication with some issues in organization or clarity. Adequate graphics and technical language.	Poor communication with significant issues in organization or clarity. Inadequate graphics or inappropriate technical language.

Criterion	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Teamwork (SLO 5)	Demonstrates excellent teamwork with clear evidence of collaboration, leadership, and effective task distribution.	Demonstrates good teamwork with evidence of collaboration and effective task distribution.	Demonstrates basic teamwork with some evidence of collaboration.	Limited evidence of effective teamwork or collaboration.
Experimentation and Data Analysis (SLO 6)	Designs and conducts appropriate experiments with excellent data analysis and valid conclusions.	Designs and conducts appropriate experiments with good data analysis and reasonable conclusions.	Conducts basic experiments with adequate data analysis and some valid conclusions.	Conducts inadequate experiments with flawed data analysis or invalid conclusions.
Lifelong Learning (SLO 7)	Demonstrates excellent ability to acquire and apply new knowledge beyond course content.	Demonstrates good ability to acquire and apply new knowledge beyond course content.	Demonstrates basic ability to acquire and apply new knowledge.	Shows limited ability to acquire and apply new knowledge.

2. Indirect Assessment Methods

Indirect assessment methods gather information about student perceptions of their learning or about factors that contribute to learning. While they do not directly measure student achievement of learning outcomes, they provide valuable complementary information that can help interpret direct assessment results and identify areas for improvement.

2.1 Surveys

Surveys collect information about student perceptions, attitudes, and experiences. They can provide insights into the learning process and identify factors that facilitate or hinder learning.

2.1.1 Types of Surveys for Engineering Assessment:

- **Course evaluation surveys**: Collect student feedback on course content, teaching methods, and overall learning experience.
- **CLO self-assessment surveys**: Ask students to rate their own achievement of course learning outcomes.

- **Program exit surveys**: Collect feedback from graduating students about their overall educational experience and perceived achievement of program outcomes.
- **Alumni surveys**: Gather information from graduates about how well their education prepared them for professional practice.
- **Employer surveys**: Collect feedback from employers about the performance of FBSU graduates in the workplace.

2.1.2 Best Practices for Using Surveys in Engineering Assessment:

- Align survey questions with specific CLOs or ABET Student Outcomes
- Use a mix of closed-ended (quantitative) and open-ended (qualitative) questions
- Keep surveys concise to encourage completion
- Administer surveys at appropriate times (e.g., mid-semester for formative feedback, end of semester for summative feedback)
- Ensure anonymity to encourage honest responses
- Analyze results in conjunction with direct assessment data
- Close the loop by sharing results and planned improvements with students

2.1.3 Example Survey Questions Aligned with Student Outcomes:

For SLO 1: Problem Solving

"*Rate your ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics*."

(Scale: 1 = Not at all prepared, 5 = Very well prepared)

For SLO 2: Design

"*How well did this course prepare you to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors?*"

(Scale: 1 = Not at all prepared, 5 = Very well prepared)

For SLO 3: Communication

"*Rate your confidence in your ability to communicate technical information effectively in writing*." (Scale: 1 = Not at all confident, 5 = Very confident)

2.2 Exit Interviews

Exit interviews are structured conversations with graduating students to gather feedback about their educational experience. They provide an opportunity for in-depth exploration of student perceptions and suggestions for improvement.

2.2.1 Topics for Exit Interviews in Engineering Programs:

- **Achievement of Student Outcomes**: Students' perceptions of how well they have achieved each of the seven ABET Student Outcomes.
- **Curriculum**: Strengths and weaknesses of the curriculum, including course sequence, content, and integration.
- **Teaching and learning**: Effectiveness of teaching methods, learning resources, and support services.
- **Facilities and resources**: Adequacy of laboratories, equipment, software, and other resources.
- **Preparation for career**: Perceived readiness for professional practice or graduate study.
- **Suggestions for improvement**: Specific recommendations for enhancing the program.

2.2.2 Best Practices for Conducting Exit Interviews in Engineering Programs:

- Develop a structured interview protocol with specific questions aligned with Student Outcomes
- Create a comfortable, non-threatening environment for honest feedback
- Consider using a neutral facilitator rather than faculty who taught the students
- Record and transcribe interviews for accurate analysis
- Look for patterns and themes across multiple interviews
- Use results to inform program improvements
- Combine with other assessment methods for a comprehensive view

2.2.3 Example Exit Interview Questions Aligned with ABET Student Outcomes:

For SLO 4: Ethics and Professional Responsibility

"*Can you describe a situation in your coursework where you had to consider ethical implications of an engineering decision? How did your education prepare you to address ethical issues in engineering*?"

For SLO 5: Teamwork

"*What experiences in your program helped you develop teamwork skills? How effective were these experiences in preparing you to work in multidisciplinary teams in the workplace?"*

For SLO 7: Lifelong Learning

"*How has your education prepared you to continue learning throughout your career? What specific skills or strategies have you developed for acquiring new knowledge independently*?"

2.3 Student Focus Groups

Focus groups bring together small groups of students to discuss specific aspects of their educational experience. They allow for interactive discussion and exploration of ideas that may not emerge in individual interviews or surveys.

2.3.1 Topics for Focus Groups in Engineering Programs:

- **Learning experiences**: Effectiveness of various teaching and learning approaches.
- **Curriculum**: Coherence, relevance, and integration of the curriculum.
- **Assessment practices**: Fairness, relevance, and effectiveness of assessment methods.
- **Support services**: Adequacy of academic advising, tutoring, and other support services.
- **Specific issues**: Exploration of particular challenges or opportunities identified through other assessment methods.

2.3.2 Best Practices for Conducting Focus Groups in Engineering Programs:

- Select a diverse group of participants to represent different perspectives
- Develop a focused set of questions or topics for discussion
- Create a non-judgmental atmosphere that encourages honest feedback
- Record and transcribe the discussion for accurate analysis
- Look for consensus and divergent views on key issues
- Use results to complement other assessment data

2.3.3 Example Focus Group Questions Aligned with Student Outcomes:

For SLO 1: Problem Solving

"*Which courses were most effective in helping you develop problem-solving skills? What specific activities or assignments were particularly valuable*?"

For SLO 2: Design

"*How well did your design experiences prepare you for real-world engineering design challenges? What additional design experiences would have been beneficial?"*

For SLO 6: Experimentation

"*How effective were laboratory experiences in helping you learn to conduct experiments and analyze data? What improvements would you suggest for laboratory courses?"*

2.4 Employer Feedback

Employer feedback provides insights into how well graduates are prepared for professional practice. It can help identify strengths and weaknesses in the curriculum from the perspective of industry needs.

2.4.1 Methods for Collecting Employer Feedback in Engineering Programs:

- **Employer surveys**: Structured questionnaires that ask employers to rate graduates' knowledge, skills, and abilities.
- **Employer interviews**: In-depth conversations with employers about graduates' performance and preparation.
- **Advisory board meetings**: Regular meetings with industry representatives to discuss program quality and relevance.
- **Internship evaluations**: Assessments of student performance during internships or co-op experiences.

2.4.2 Best Practices for Using Employer Feedback in Engineering Assessment:

- Align feedback questions with Student Outcomes
- Collect feedback from a diverse range of employers
- Establish regular cycles for collecting and analyzing feedback
- Combine quantitative ratings with qualitative comments
- Use feedback to identify emerging industry needs and trends
- Involve employers in curriculum development and review
- Close the loop by sharing how feedback has influenced program improvements

2.4.3 Example Employer Feedback Questions Aligned with ABET Student Outcomes:

For SLO 1: Problem Solving

"*Rate the graduate's ability to identify, formulate, and solve complex engineering problems*." (Scale: 1 = Poor, 5 = Excellent)

For SLO 3: Communication

"*How effectively does the graduate communicate technical information in written and oral forms*?" (Scale: 1 = Poor, 5 = Excellent)

For SO 5: Teamwork

"*Rate the graduate's ability to function effectively on multidisciplinary teams*."

(Scale: 1 = Poor, 5 = Excellent)

3. Selecting Appropriate Assessment Methods

Different types of learning outcomes require different assessment methods. Selecting appropriate methods ensures that assessment provides valid and reliable evidence of student achievement.

3.1 Matching Assessment Methods to Bloom's Taxonomy Levels

The cognitive level of a CLO should guide the selection of assessment methods:

- **Remember and Understand**: Multiple-choice questions, short-answer questions, concept maps, definitions.
- **Apply**: Problem sets, case studies, simulations, laboratory exercises, programming assignments.
- **Analyze**: Case studies, research papers, data analysis projects, comparative analyses, troubleshooting exercises.
- **Evaluate**: Critiques, reviews, case analyses, justification of positions, experimental evaluations.
- **Create**: Design projects, research projects, creative works, business plans, and prototypes.

3.2 Matching Assessment Methods to Student Outcomes

Different Student Outcomes require different assessment approaches:

- **SLO** 1: Problem Solving: Problem sets, exams with analytical problems, case studies, design projects.
- **SLO** 2: Design: Design projects, capstone projects, case studies, simulations.
- **SLO** 3: Communication: Written reports, oral presentations, technical documentation, poster presentations.
- **SLO** 4: Ethics and Professional Responsibility: Case studies, ethical analyses, position papers, debates.
- **SLO** 5: Teamwork: Team projects, peer evaluations, team presentations, reflective journals.
- **SLO** 6: Experimentation: Laboratory reports, experimental design projects, data analysis assignments, research projects.
- **SLO** 7: Lifelong Learning: Research projects, self-directed learning assignments, reflective journals, professional development plans.

3.3 Using Multiple Assessment Methods

Using multiple assessment methods provides a more comprehensive view of student learning and accommodates different learning styles. A balanced assessment plan might include:

- Formative and summative assessments: Formative assessments provide feedback during the learning process, while summative assessments evaluate achievement at the end of a unit or course.

- Individual and group assessments: Individual assessments measure each student's achievement, while group assessments evaluate collaborative skills and collective outcomes.
- Written, oral, and performance assessments: Different formats allow students to demonstrate learning in various ways.
- Direct and indirect assessments: Direct assessments measure actual learning, while indirect assessments provide contextual information about the learning experience.

4. Assessment Planning Matrix

An assessment planning matrix helps ensure that all CLOs are appropriately assessed using suitable methods. The matrix, as shown in Table 8, maps CLOs to assessment methods and indicates the weight or importance of each method for each outcome.

4.1 Example Assessment Planning Matrix for an Engineering Course:

Table 8: CLOs Assessment Tools mapping

Course Learning Outcome	Exams/Quizzes	Projects	Lab Reports	Presentations	Homework
CLO 1: Apply principles of thermodynamics to analyze energy conversion systems	80%	10%	-	-	10%
CLO 2: Design a thermal system that meets specified requirements	40%	60%			-
CLO 3: Communicate design solutions through technical reports and presentations	-	30%		70%	-
CLO 4: Evaluate the environmental impact of thermal systems	50%				50%
CLO 5: Conduct experiments to measure thermal properties and analyze the results	10%	-	70%	20%	-

4.2 Considerations for Selecting Assessment Methods

When selecting assessment methods for engineering courses at FBSU, consider the following factors:

- **Validity**: Does the assessment method measure what it is intended to measure?
- **Reliability**: Does the assessment method produce consistent results?
- **Authenticity**: Does the assessment reflect real-world applications of knowledge and skills?

- **Efficiency**: Is the assessment method practical in terms of time and resources?
- **Alignment**: Does the assessment method align with the teaching and learning activities?
- **Inclusivity**: Does the assessment method accommodate diverse learning styles and needs?
- **Feedback**: Does the assessment method provide useful feedback for improvement?

4.3 Assessment Implementation Process

Implementing effective assessment in engineering courses at FBSU involves a systematic process that ensures alignment with CLOs and Student Outcomes.

4.3.1 Planning Assessment Activities

1) Identify CLOs to be assessed: Define the CLOs will be assessed in the course.
2) Map CLOs to Student Outcomes: Ensure that the CLOs align with and contribute to the achievement of Student Outcomes.
3) Select appropriate assessment methods: Choose methods that are suitable for the cognitive level and content of each CLO.
4) Develop assessment instruments: Create exams, project descriptions, rubrics, and other assessment tools.
5) Establish performance criteria: Define what constitutes acceptable performance for each assessment.
6) Create an assessment schedule: Plan when each assessment will be administered during the semester.

4.3.2 Administering Assessments

a) Communicate expectations to students: Provide clear instructions and rubrics for each assessment.
b) Administer assessments according to schedule: Ensure that assessments are conducted as planned.
c) Maintain assessment security: Protect the integrity of assessment instruments and processes.
d) Provide timely feedback: Give students feedback on their performance to support learning.

4.3.3 Analyzing Assessment Results

a) Collect and organize assessment data: Gather all assessment results in a systematic way.
b) Calculate achievement levels: Determine the percentage of students achieving each CLO at or above the target level.

c) Identify strengths and weaknesses: Analyze the results to identify areas where students are performing well and areas where they are struggling.

d) Compare results with targets: Determine whether performance meets established targets.

e) Identify trends: Look for patterns in the data that may indicate systemic issues or improvements.

4.3.4 Using Assessment Results for Improvement

Discuss results with faculty: Share assessment results with colleagues to gain additional insights.

a) Identify areas for improvement: Based on the analysis, determine which aspects of the course need improvement.

b) Develop action plans: Create specific plans for addressing identified weaknesses.

c) Implement improvements: Make changes to course content, teaching methods, or assessment approaches.

d) Document the process: Record the assessment results, analysis, and improvements for future reference.

e) Evaluate effectiveness: In subsequent semesters, assess whether the improvements have had the desired effect.

Figure 23: Assessment Implementation Process

5. Conclusion

Effective assessment is essential for ensuring that engineering students at FBSU achieve the Course Learning Outcomes and ABET Student Outcomes that prepare them for successful professional practice. By using a combination of direct and indirect assessment methods, faculty can gather comprehensive evidence of student learning and use this evidence to continuously improve the quality of engineering education at FBSU.

The assessment methods and tools described in this section provide a framework for implementing assessment that is aligned with national and international accreditation requirements and supports the achievement of FBSU's educational mission. By following these guidelines, faculty can develop assessment practices that not only satisfy accreditation requirements but also enhance student learning and program quality.

Section V

Implementation Guidelines

1. Course Assessment Timeline

Implementing a systematic assessment process requires careful planning and adherence to a timeline that ensures all necessary activities are completed within each academic semester. The following timeline provides a framework for course assessment activities at FBSU:

1.1 Before the Semester Begins

Week -2 to -1: Preparation Phase

Review Course Learning Outcomes (CLOs):

- Verify alignment with ABET Student Outcomes
- Update CLOs if necessary based on previous assessment results
- Ensure CLOs are measurable and appropriate for the course level

Develop Assessment Plan:

- Select appropriate direct and indirect assessment methods for each CLO
- Create or revise assessment instruments (exams, projects, rubrics)
- Establish performance targets for each CLO
- Prepare the course syllabus with clear CLOs and assessment methods

Coordinate with Department:

- Ensure alignment with program assessment plan
- Confirm which Student Outcomes will be assessed in the course
- Review any department-specific assessment requirements

1.2 During the Semester

a) Weeks 1-2: Initiation Phase

Communicate with Students:

- Introduce CLOs and their importance
- Explain assessment methods and expectations
- Distribute rubrics and performance criteria

Baseline Assessment (Optional):

- Conduct pre-tests or surveys to establish baseline knowledge
- Identify areas where students may need additional support

b) Weeks 3-7: First Assessment Cycle

Implement Formative Assessments:

- Conduct quizzes, homework assignments, or short projects
- Provide feedback to students on their progress

- Identify areas where students are struggling

Mid-term Assessment:

- Administer mid-term exam or project
- Assess student achievement of CLOs covered in the first half of the course
- Document assessment results

c) Week 8: Mid-semester Review

Analyze Mid-term Results:

- Calculate achievement levels for each CLO assessed
- Identify strengths and weaknesses
- Adjust teaching strategies if necessary

Mid-semester Feedback:

- Collect student feedback on the course
- Share assessment results with students
- Discuss plans for improvement

d) Weeks 9-14: Second Assessment Cycle

Continue Formative Assessments:

- Implement additional quizzes, assignments, or projects
- Focus on areas identified as weaknesses in mid-term assessment
- Document ongoing assessment results

Major Projects or Assignments:

- Assign comprehensive projects that integrate multiple CLOs
- Provide clear guidelines and rubrics
- Monitor progress and provide feedback

e) Weeks 15-16: Final Assessment Phase

Final Examinations or Projects:

- Administer comprehensive final assessment
- Ensure all CLOs are assessed by the end of the semester
- Document final assessment results

Indirect Assessment:

- Administer course evaluation surveys
- Conduct CLO self-assessment surveys
- Collect student feedback on the course

1.3 After the Semester Ends

a) Weeks 17-18: Analysis and Reporting Phase

Compile Assessment Data:

- Gather all direct and indirect assessment results
- Organize data by CLO and ABET Student Outcome

Analyze Results:

- Calculate achievement levels for each CLO
- Compare results with performance targets
- Identify strengths and weaknesses

Prepare Course Assessment Report:

- Document assessment methods and results
- Analyze achievement of CLOs
- Identify areas for improvement
- Develop action plans for the next offering of the course

Submit Report to Department:

- Share assessment results with department chair and program coordinator
- Contribute to program-level assessment data
- Participate in department assessment meetings

2. Annual/Semi-Annual Assessment Cycle

Beyond the semester timeline, courses participate in an annual assessment cycle that includes:

- **Annual Program Assessment Meeting (End of Academic Year):**
  - Review assessment results from all courses
  - Identify program-level strengths and weaknesses
  - Develop program improvement plans
- **Curriculum Review (Summer):**
  - Evaluate the effectiveness of the curriculum in achieving ABET Student Outcomes
  - Identify gaps or redundancies in the curriculum
  - Recommend curriculum changes if necessary
- **Assessment Planning (Before New Academic Year):**
  - Update assessment plans based on previous year's results
  - Implement improvements to assessment methods

- Prepare for the new academic year

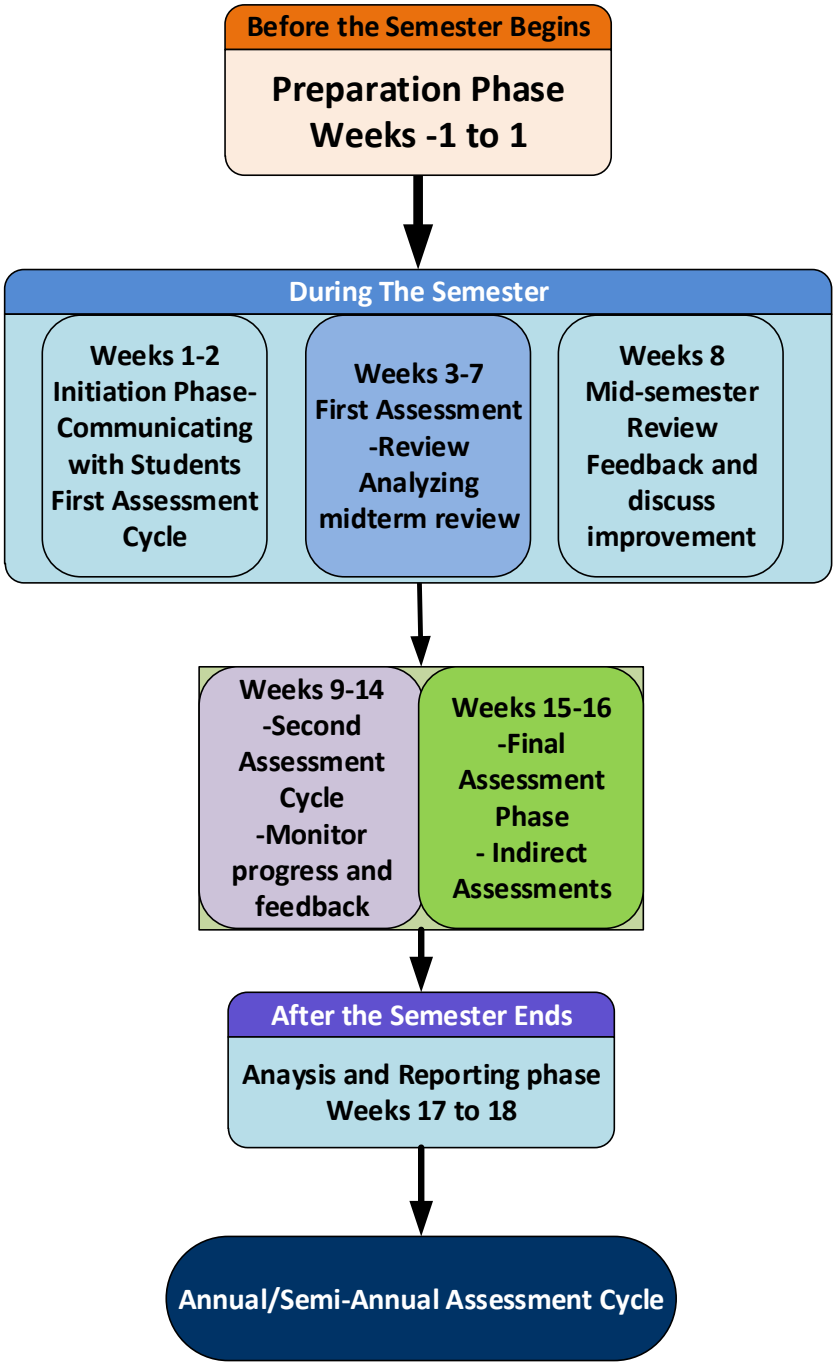


Figure 24: Course Assessment Timeline

3. Data Collection Procedures

Effective assessment requires systematic collection of data that provides valid and reliable evidence of student achievement of CLOs. The following procedures guide the collection of assessment data at FBSU:

3.1 Direct Assessment Data Collection

- **Embedded Assessments in Courses:**
  - Identify specific questions, problems, or components of assignments that will be used for assessment
  - Create clear marking criteria aligned with CLOs
  - Use consistent scoring methods across sections of the same course
  - Document which assessment items correspond to which CLOs
- **Sampling Approach:**
  - For large classes, a representative sample of student work may be used for detailed assessment
  - Ensure the sample includes work from students at different performance levels
  - Minimum sample size should be 40% of the class or 10 students, whichever is larger
  - For program-level assessment, include samples from multiple course sections
- **Collection Methods:**
  - Use the university's learning management system to collect and organize student work
  - Maintain digital copies of all assessment artifacts
  - Use standardized forms for recording assessment data
  - Ensure that assessment data can be disaggregated by CLO and Student Outcome
- **Documentation Requirements:**
  - Keep copies (hard or Soft) of assessment instruments (exams, project descriptions, rubrics)
  - Maintain records of student performance on each assessment
  - Document the mapping between assessment items and CLOs
  - Preserve examples of student work at different performance levels

3.2 Indirect Assessment Data Collection

➢ **Survey Administration:**

- Use standardized surveys developed by the Deanship of Quality and Academic Accreditation
- Administer surveys at appropriate times (mid-semester, end of semester)
- Ensure student anonymity to encourage honest responses
- Aim for high response rates (minimum 70% of enrolled students)

➢ **Focus Groups and Interviews:**

- Develop structured protocols with specific questions
- Select diverse participants to represent different perspectives
- Record sessions with participant permission
- Transcribe recordings for analysis

➢ **Employer and Alumni Feedback:**

- Use standardized forms developed by the Deanship of Quality and Academic Accreditation
- Collect feedback on a regular schedule (annually for employers, every 2-3 years for alumni)
- Maintain contact information database for alumni and employers
- Document response rates and representativeness of respondents

3.3 Data Management and Security

➢ **Data Storage:**

- Store assessment data in secure, password-protected systems
- Maintain backup copies of all assessment data
- Organize data by course, semester, and academic year
- Ensure data can be accessed by authorized personnel for analysis

➢ **Confidentiality:**

- Remove student identifying information from assessment data used for analysis
- Comply with university policies on data privacy and security
- Obtain appropriate permissions for using student work in assessment reports
- Ensure secure handling of sensitive information

- **Data Retention:**
  - Retain assessment data for a minimum of six years (*two international accreditation cycles*)
  - Maintain archives of assessment reports and improvement plans
  - Establish procedures for secure disposal of outdated assessment data
  - Document the data retention and disposal process

3.4 Documentation Requirements

Proper documentation is essential for maintaining a record of assessment activities, results, and improvements. The following documentation should be maintained for each course and program:

3.4.1 Course-Level Documentation

- **Course Syllabus:**
  - Course description and objectives
  - Course Learning Outcomes (CLOs)
  - Mapping of CLOs to Student Outcomes
  - Assessment methods and their weights
  - Schedule of assessment activities
- **Assessment Instruments:**
  - Copies of exams, quizzes, and assignment descriptions
  - Rubrics and scoring guides
  - Project guidelines and evaluation criteria
  - Laboratory manuals and report guidelines
- **Assessment Results:**
  - Summary of student performance on each assessment
  - Analysis of achievement levels for each CLO
  - Comparison of results with performance targets
  - Identification of strengths and weaknesses
- **Course Assessment Report:**
  - Overview of the course and its role in the curriculum
  - Summary of assessment methods and results

- Analysis of student achievement of CLOs
- Recommendations for improvement
- Action plans for the next offering of the course

➢ **Evidence of Improvement:**

- Documentation of changes made based on assessment results
- Comparison of results before and after improvements
- Evaluation of the effectiveness of improvements
- Plans for ongoing monitoring and improvement

3.4.2 Program-Level Documentation

➢ **Program Assessment Plan:**

- Program Educational Objectives
- Student Learning Outcomes
- Curriculum map showing where each outcome is addressed
- Assessment methods for each outcome
- Schedule for assessment activities

➢ **Annual Program Assessment Report:**

- Summary of assessment activities for the academic year
- Analysis of achievement of (PLO, SLO, PI) Student Outcomes
- Identification of program strengths and weaknesses
- Recommendations for program improvement
- Action plans for the next academic year

➢ **Continuous Improvement Documentation:**

- Record of program changes based on assessment results
- Evidence of the effectiveness of improvements
- Documentation of "closing the loop" in the assessment process
- Long-term trends in student achievement of outcomes

➢ **Advisory Board Meeting Minutes:**

- Feedback from industry representatives
- Recommendations for program improvement

- Program responses to advisory board recommendations
- Documentation of changes made based on advisory board input

3.4.3 Documentation Format and Organization

➢ **Standardized Templates:**

- Use standardized templates for all assessment documentation
- Ensure consistency across courses and programs
- Include all required elements in each document
- Use clear, concise language and appropriate formatting

➢ **Electronic Repository:**

- Maintain an electronic repository of all assessment documentation
- Organize files by academic year, program, and course
- Ensure accessibility to authorized faculty and administrators
- Implement regular backup procedures

➢ **Documentation Review Process:**

- Establish a process for reviewing assessment documentation
- Ensure completeness and quality of documentation
- Provide feedback to faculty on documentation quality
- Use documentation review as an opportunity for improvement

4. Analysis Techniques

Effective analysis of assessment data is crucial for identifying strengths, weaknesses, and opportunities for improvement. The following techniques should be used to analyze assessment data at FBSU:

4.1 Quantitative Analysis Techniques

4.1.1 Descriptive Statistics:

- Calculate mean, median, and standard deviation of student performance
- Determine the percentage of students achieving each CLO at or above the target level
- Compare results across different sections of the same course
- Analyze trends over multiple offerings of the course

4.1.2 Performance Gap Analysis:

- Identify gaps between expected and actual performance
- Calculate the difference between target and actual achievement levels
- Prioritize CLOs with the largest performance gaps for improvement
- Track changes in performance gaps over time

4.1.3 Correlation Analysis:

- Examine relationships between different assessment methods
- Identify correlations between achievement of different CLOs
- Analyze the relationship between course performance and program outcomes
- Investigate factors that may influence student achievement

4.1.4 Longitudinal Analysis:

- Track changes in student performance over time
- Identify trends and patterns in achievement of CLOs
- Evaluate the effectiveness of improvements over multiple semesters
- Analyze cohort progression through the curriculum

4.2 Qualitative Analysis Techniques

4.2.1 Content Analysis:

- Analyze written comments from surveys and interviews
- Identify common themes and patterns in student feedback
- Extract specific suggestions for improvement
- Use direct quotes to illustrate key points

4.2.2 Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis:

- Identify strengths in student achievement of CLOs
- Recognize weaknesses or areas for improvement
- Explore opportunities for enhancing teaching and learning
- Consider threats or challenges to student success

4.2.3 Root Cause Analysis:

- Investigate underlying causes of performance gaps
- Use the "5 Whys" technique to identify root causes
- Distinguish between symptoms and causes of problems
- Develop targeted interventions based on root causes

4.2.4 Comparative Analysis (benchmarking):

- Compare results across different courses in the program
- Benchmark against similar programs at other institutions
- Contrast performance of different student cohorts
- Examine differences between high and low-performing students

4.3 Integrated Analysis Approach

4.3.1 Triangulation of Data Sources:

- Compare results from different assessment methods
- Integrate direct and indirect assessment data
- Verify findings through multiple sources of evidence
- Identify consistencies and discrepancies in the data

4.3.2 Contextual Analysis:

- Consider contextual factors that may influence results
- Analyze the impact of changes in curriculum or teaching methods
- Account for external factors such as student preparation or resources
- Interpret results within the broader educational context

4.3.3 Collaborative Analysis:

- Engage multiple faculty in analyzing assessment data
- Conduct assessment meetings to discuss results
- Seek diverse perspectives on the interpretation of data
- Develop consensus on findings and recommendations

4.3.4 Action-Oriented Analysis:

- Focus on identifying specific areas for improvement
- Prioritize issues based on impact and feasibility
- Link analysis directly to action plans
- Establish clear connections between findings and recommendations

5. Continuous Improvement Processes

Continuous improvement is at the heart of effective assessment. The following processes guide the use of assessment results for improving teaching and learning at FBSU:

5.1 Course-Level Improvement Process

5.1.1 Identify Areas for Improvement:

- Review assessment results to identify CLOs with low achievement levels
- Analyze student performance on specific assessment items
- Consider student feedback from surveys and evaluations
- Prioritize areas with the greatest potential for improvement

5.1.2 Develop Improvement Strategies:

- Brainstorm potential strategies for addressing identified weaknesses
- Consider changes to teaching methods, course content, or assessment approaches
- Consult with colleagues for ideas and best practices
- Select strategies that are feasible and likely to be effective

5.1.3 Implement Improvements:

- Make specific changes to course materials, activities, or assessments
- Communicate changes to students and explain the rationale
- Document the implementation of improvements
- Monitor the impact of changes during the semester

5.1.4 Evaluate Effectiveness:

- Assess student performance after implementing improvements
- Compare results before and after changes
- Collect student feedback on the effectiveness of changes
- Determine whether performance targets have been met

5.1.5 Refine and Continue:

- Adjust improvement strategies based on evaluation results
- Continue successful strategies and modify or replace ineffective ones
- Document the continuous improvement process
- Share successful strategies with colleagues

5.2 Program-Level Improvement Process

5.2.1 Annual Program Assessment Review:

- Compile assessment results from all courses
- Analyze achievement of Student Outcomes at the program level

- Identify program strengths and weaknesses
- Prioritize areas for program improvement

5.2.2 Develop Program Improvement Plans:

- Create specific action plans for addressing program weaknesses
- Assign responsibilities for implementing improvements
- Establish timelines for implementation and evaluation
- Allocate resources to support improvement efforts

5.2.3 Curriculum Review and Revision:

- Evaluate the effectiveness of the curriculum in achieving program outcomes
- Identify gaps or redundancies in the curriculum
- Propose changes to course content, sequence, or requirements
- Implement curriculum revisions through established university processes

5.2.4 Faculty Development:

- Provide training and support for faculty in areas needing improvement
- Share best practices for teaching and assessment
- Encourage innovation in teaching methods
- Recognize and reward faculty contributions to program improvement

5.2.5 Stakeholder Involvement:

- Engage advisory board members in the improvement process
- Seek input from employers and alumni
- Involve students in discussions about program improvement
- Collaborate with other departments and programs

6. Closing the Loop

"Closing the loop" refers to the process of using assessment results to make improvements and then assessing the effectiveness of those improvements. This cyclical process is essential for continuous improvement:

6.1 Document Improvements:

- Record specific changes made based on assessment results
- Describe the rationale for each improvement
- Note the expected impact on student learning

- Maintain a history of improvements over time

6.2 Reassess After Implementation:

- Use the same or similar assessment methods to evaluate the impact
- Collect data on student achievement of the targeted CLOs
- Compare results before and after improvements
- Determine whether performance targets have been met

6.3 Analyze Effectiveness:

- Evaluate whether improvements had the intended effect
- Identify factors that contributed to success or failure
- Consider unintended consequences of changes
- Determine whether additional improvements are needed

6.4 Report Results:

- Document the effectiveness of improvements
- Share results with department and program faculty
- Include information in annual assessment reports
- Use results to inform future improvement efforts

6.5 Continuous Cycle:

- Maintain an ongoing cycle of assessment, improvement, and reassessment
- Build on successful improvements
- Learn from less successful efforts
- Foster a culture of continuous improvement

6.6 Example of Closing the Loop

6.6.1 Initial Assessment:

- Assessment of CLO: "Design a reinforced concrete beam that meets specified requirements."
- Method: Design project evaluated using a rubric
- Result: 65% of students achieved the target performance level (target: 70%)
- Analysis: Students struggled with applying design codes and considering multiple constraints

6.6.2 Improvement Actions:

- Added more in-class examples of design code application
- Developed a step-by-step guide for the design process
- Created additional practice problems with feedback
- Incorporated peer review of preliminary designs

6.6.3 Reassessment:

- Same CLO assessed in the next offering of the course
- Same method (design project) and rubric used
- Result: 78% of students achieved the target performance level
- Analysis: Improvement actions were effective in addressing the identified weaknesses

6.6.4 Documentation:

- Course assessment report documents the improvement process
- Specific changes and their rationale are described
- Evidence of improved student performance is presented
- Successful strategies are shared with other faculty

7. Faculty Support and Resources

Effective implementation of assessment requires adequate support and resources for faculty. FBSU provides the following support to assist faculty in the assessment process:

7.1 Training and Professional Development

7.1.1 Assessment Workshops:

- Introduction to assessment for new faculty
- Advanced assessment techniques for experienced faculty
- Rubric development and use
- Data analysis and interpretation
- Using assessment results for improvement

7.1.2 Mentoring Program:

- Pairing new faculty with experienced mentors
- Regular meetings to discuss assessment practices

- Observation and feedback on assessment implementation
- Guidance on documentation and reporting

7.1.3 Learning Communities:

- Faculty groups focused on specific assessment topics
- Regular meetings to share experiences and best practices
- Collaborative development of assessment tools
- Peer review of assessment plans and reports

7.2 Technical Support

7.2.1 Assessment Management System:

- Access to software for collecting and analyzing assessment data
- Training on using the assessment management system
- Technical support for resolving issues
- Regular updates and improvements to the system

7.2.2 Data Analysis Support:

- Assistance with statistical analysis of assessment data
- Tools for visualizing assessment results
- Support for interpreting complex data
- Guidance on using data for decision-making

7.2.3 Documentation Templates:

- Standardized templates for assessment plans
- Forms for recording assessment results
- Templates for course and program assessment reports
- Checklists for ensuring complete documentation

7.3 Resource Materials

7.3.1 Assessment Handbook:

- Comprehensive guide to assessment principles and practices
- Examples of effective assessment methods
- Guidelines for developing and using rubrics
- Strategies for using assessment results for improvement

7.3.2 Sample Assessment Tools:

- Examples of effective assessment instruments
- Sample rubrics for different types of assignments
- Templates for surveys and interview protocols
- Models of well-documented assessment reports

7.3.3 Online Resources:

- Access to assessment literature and research
- Links to professional organizations and resources
- Repository of best practices in engineering assessment
- Videos and tutorials on assessment techniques

7.4 Administrative Support

7.4.1 Deanship of Quality and Academic Accreditation:

- Guidance on assessment policies and procedures
- Review of assessment plans and reports
- Coordination of program-level assessment
- Support for ABET accreditation preparation

7.4.2 Department Assessment Coordinators:

- Assistance with course-level assessment planning
- Review of assessment instruments and methods
- Support for data collection and analysis
- Feedback on assessment reports

7.4.3 Time and Workload Considerations:

- Recognition of assessment activities in faculty workload
- Release time for major assessment initiatives
- Consideration of assessment contributions in performance evaluation
- Support for faculty scholarship related to assessment

8. Student Involvement in Assessment

Students are important stakeholders in the assessment process. Their active involvement can enhance the effectiveness of assessment and contribute to a culture of continuous improvement:

8.1 Communicating with Students about Assessment

8.1.1 Orientation to Assessment:

- Introduce students to the purpose and value of assessment
- Explain the role of assessment in improving education
- Clarify the connection between assessment and ABET accreditation
- Distinguish between assessment and grading

8.1.2 Transparency in Assessment Processes:

- Share CLOs and their alignment with ABET Student Outcomes
- Provide clear rubrics and performance criteria
- Explain how assessment results are used for improvement
- Communicate changes made based on previous assessment results

8.1.3 Regular Feedback:

- Provide timely feedback on assessments
- Relate feedback to specific CLOs
- Use feedback to guide improvement
- Encourage student self-assessment

8.2 Student Participation in Assessment Activities

8.2.1 Self-Assessment:

- Guide students in assessing their own work
- Provide opportunities for reflection on learning
- Encourage students to identify strengths and areas for improvement
- Help students develop skills for lifelong learning

8.2.2 Peer Assessment:

- Train students in providing constructive feedback
- Implement structured peer review activities

- Use peer assessment to enhance learning
- Monitor and guide the peer assessment process

8.2.3 Student Representatives:

- Include student representatives in program assessment committees
- Seek student input on assessment methods
- Involve students in discussions about program improvement
- Share assessment results with student representatives

8.3 Using Student Feedback for Improvement

8.3.1 Course Evaluations:

- Include questions about the effectiveness of teaching and assessment
- Analyze student feedback for insights into areas for improvement
- Share aggregated feedback with faculty
- Demonstrate responsiveness to student feedback

8.3.2 Focus Groups and Interviews:

- Conduct focus groups to explore student experiences
- Interview students about specific aspects of the program
- Use student insights to inform improvement efforts
- Follow up with students on changes made based on their feedback

8.3.3 Student Surveys:

- Administer surveys on specific aspects of the program
- Collect student self-assessments of achievement of CLOs
- Analyze survey results for patterns and trends
- Use results to identify areas for improvement

8.4 Protecting Student Privacy

8.4.1 Confidentiality of Assessment Data:

- Remove identifying information from assessment data
- Aggregate data to protect individual privacy
- Secure storage of assessment records
- Comply with university policies on student privacy

8.4.2 Informed Consent:

- Obtain permission for using student work in assessment reports
- Explain how student work will be used
- Provide options for students who do not wish to participate
- Document the consent process

8.4.3 Ethical Use of Student Data:

- Use assessment data only for its intended purpose
- Maintain confidentiality in discussions of assessment results
- Ensure fair treatment of all students in the assessment process
- Consider potential impacts on students when implementing changes

9. Examples of course assessments using the Assessment Portal:

9.1 Syllabi design and creation

For each course, instructors are required to develop a comprehensive syllabus that incorporates all the essential components outlined in the preceding sections. The syllabus serves as a foundational document, ensuring alignment with program standards and institutional guidelines.

To illustrate this process, Figure 25 provides an example of using the assessment portal to prepare a well-defined syllabus. It demonstrates how instructors are responsible for designing their course syllabi in accordance with the standards and frameworks established by the Program Quality Committees. This includes adherence to learning outcomes, assessment methods, and institutional policies to maintain consistency and quality across all courses.

Figures 26 and 27 show an example of a well-structured syllabus.

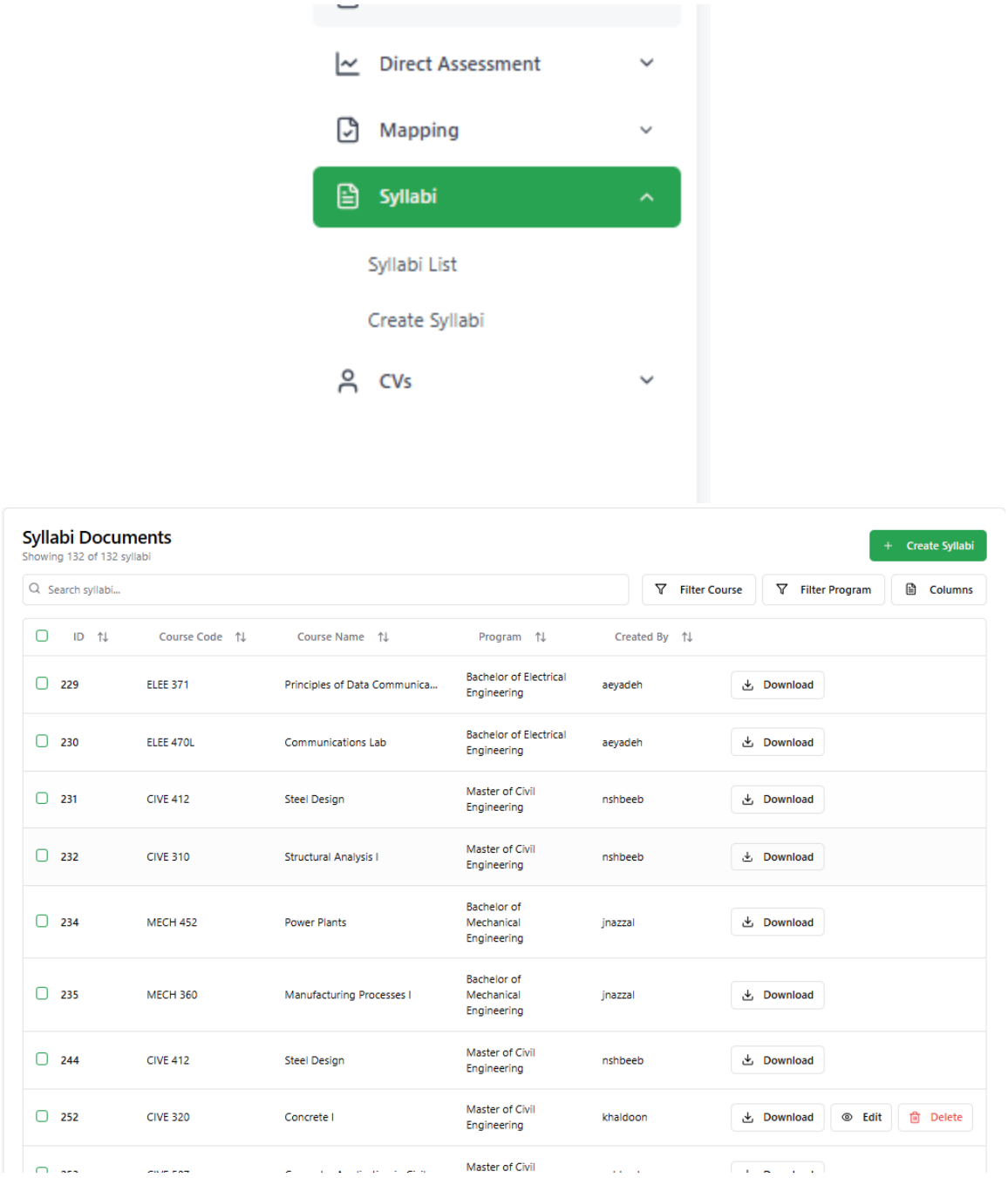


Figure 25: The creation of Syllabus in the assessment portal

FAHAD BIN SULTAN UNIVERSITY
COLLEGE OF ENGINEERING
RENEWABLE ENERGY ENGINEERING DEPARTMENT

ELEE 242: Electronics for Non-electrical Students

Spring 2024-2025

Catalogue Description

(3 credit hours) [A course on semiconductors; semiconductor devices including PN junctions, Diodes, MOS field effect transistors (MOSFET), Bipolar junction transistors (BJT), operational amplifiers (OP-AMPs) device characteristics. The course covers fundamental skills in analysis of electronic circuits: DC biasing, AC small signal analysis].

Prerequisite(s): ELEE 212— Circuits for Non-electrical Students

Textbook

Course notes and resources, which are based on the textbooks listed in the References section, are posted on Moodle.

Reference(s)

Microelectronic Circuits, 6th Edition, Adel S. Sedra and Kenneth C. Smith, Oxford University Press, 2004.
Microelectronics: Circuit Analysis and Design, 4th Edition, Donald Neamen, McGraw-Hill, 2010.
Electronic Devices, T.L. Floyd,, Second Edition,Merrill, 1988.

Instructor

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Office hours: Su, Tu, Thu: 8:00-10:00,12:00:13:00, Mo, Wed: 10:00-12:30

Course Topics

Week	Topic	Chapter(s) in textbook
Week 1-2	Introduction to Semiconductors	1
Week 3-5	Diodes and Their Properties	2
Week 6-8	Field-Effect Transistors (FETs)	9
Week 9-11	Bipolar Junction Transistors (BJTs)	4
Week 12-14	Operational Amplifiers (Op-Amps)	12

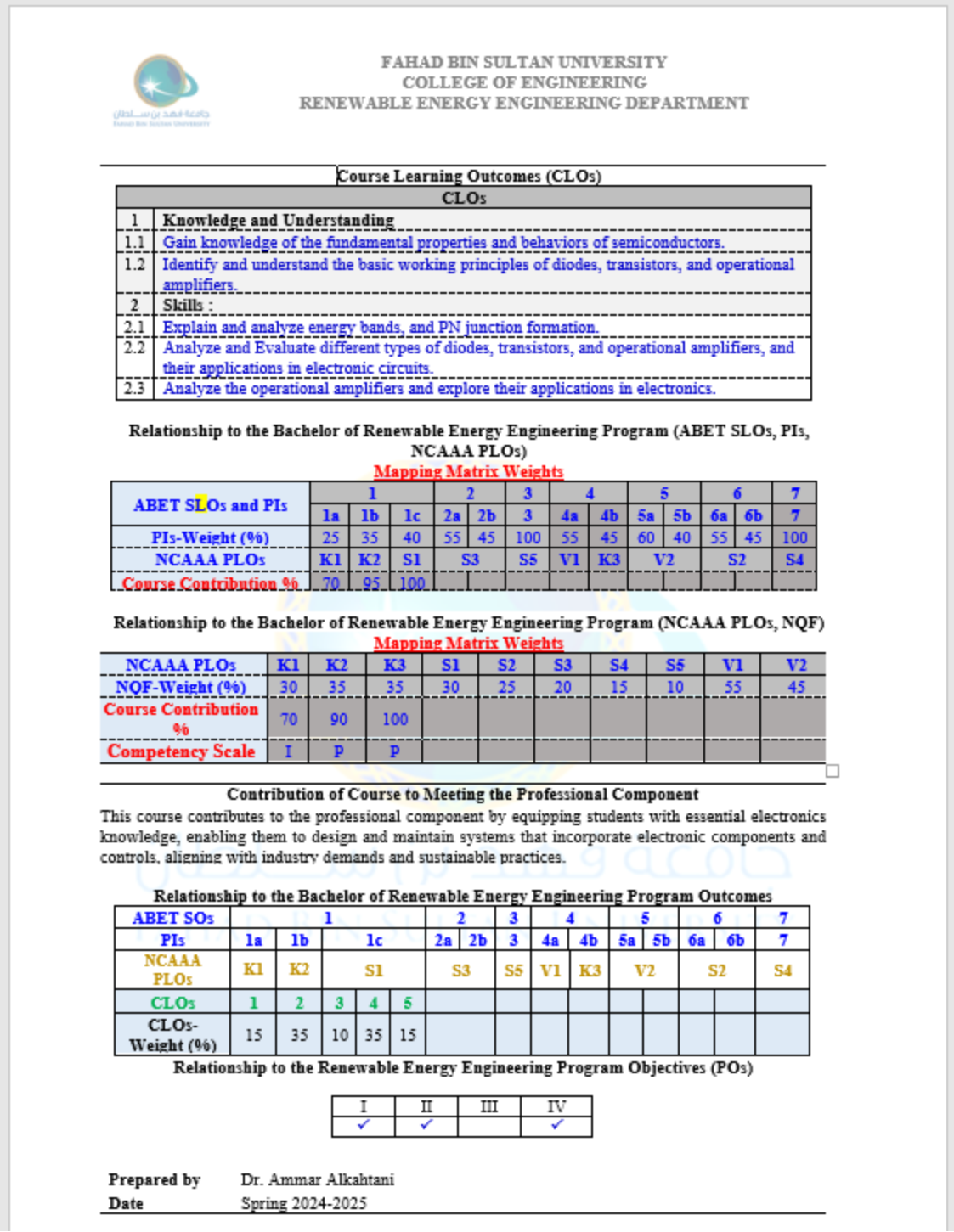
Grading Policy

Attendance and Participation:	05%
Assignments:	10%
First Exam	15%
Second Exam:	15%
Quizzes	5%
Final Exam	40%

Course Objectives

1) Understand the fundamental properties, physics, and behavior of semiconductors.
2) Understand the basic working principles of diodes and transistors in electronic circuits.
3) Analyze and evaluate transistor operations and biasing techniques
4) Analyze various operational amplifiers circuits

Figure 26: First page of prepared syllabus using the assessment portal for course ELEE 242



FAHAD BIN SULTAN UNIVERSITY
COLLEGE OF ENGINEERING
RENEWABLE ENERGY ENGINEERING DEPARTMENT

Course Learning Outcomes (CLOs)

	CLOs
1	**Knowledge and Understanding**
1.1	Gain knowledge of the fundamental properties and behaviors of semiconductors.
1.2	Identify and understand the basic working principles of diodes, transistors, and operational amplifiers.
2	**Skills :**
2.1	Explain and analyze energy bands, and PN junction formation.
2.2	Analyze and Evaluate different types of diodes, transistors, and operational amplifiers, and their applications in electronic circuits.
2.3	Analyze the operational amplifiers and explore their applications in electronics.

Relationship to the Bachelor of Renewable Energy Engineering Program (ABET SLOs, PIs, NCAAA PLOs)

Mapping Matrix Weights

ABET SLOs and PIs	1			2		3	4		5		6		7
	1a	1b	1c	2a	2b	3	4a	4b	5a	5b	6a	6b	7
PIs-Weight (%)	25	35	40	55	45	100	55	45	60	40	55	45	100
NCAAA PLOs	K1	K2	S1	S3		S5	V1	K3	V2		S2		S4
Course Contribution %	70	95	100										

Relationship to the Bachelor of Renewable Energy Engineering Program (NCAAA PLOs, NQF)

Mapping Matrix Weights

NCAAA PLOs	K1	K2	K3	S1	S2	S3	S4	S5	V1	V2
NQF-Weight (%)	30	35	35	30	25	20	15	10	55	45
Course Contribution %	70	90	100							
Competency Scale	I	P	P							

Contribution of Course to Meeting the Professional Component

This course contributes to the professional component by equipping students with essential electronics knowledge, enabling them to design and maintain systems that incorporate electronic components and controls, aligning with industry demands and sustainable practices.

Relationship to the Bachelor of Renewable Energy Engineering Program Outcomes

ABET SOs	1					2		3	4		5		6		7
PIs	1a	1b	1c			2a	2b	3	4a	4b	5a	5b	6a	6b	7
NCAAA PLOs	K1	K2	S1			S3		S5	V1	K3	V2		S2		S4
CLOs	1	2	3	4	5										
CLOs-Weight (%)	15	35	10	35	15										

Relationship to the Renewable Energy Engineering Program Objectives (POs)

I	II	III	IV
✓	✓		✓

Prepared by Dr. Ammar Alkahtani
Date Spring 2024-2025

Figure 27: Second page of prepared syllabus using the assessment portal for course ELEE 242

As illustrated in Figure 27, all required assessment data - including Course Learning Outcomes (CLOs), course reports, and their alignment with Program Learning Outcomes (PLOs) or Student Learning Outcomes (SLOs) and Performance Indicators (PIs) - are

numerically weighted within the system. This structured approach enables the automated generation of CLO assessment results for each course.

The system further aggregates these results to determine the contribution of individual courses to the overall assessment of PLOs. Program chairpersons utilize this consolidated data to evaluate student outcome achievement, ensuring informed decision-making and continuous program improvement

9.2 CLOs input in the Quality Management Assessment Portal

For each course, the instructor must:

- **Define** the Course Learning Outcomes (CLOs)
- **Map** each CLO to the relevant Program/Student Learning Outcome (PLO/SLO)
- **Assign weights** to indicate each CLO's relative contribution when multiple CLOs align with the same PLO, These weightings must sum to 100% for all CLOs mapped to a single PLO, ensuring proportional representation in program-level assessment

This structured mapping ensures accurate assessment of how individual courses contribute to overall program outcomes. Figure 28 illustrates the data entry interface for this process, showing how instructors input this critical alignment information.

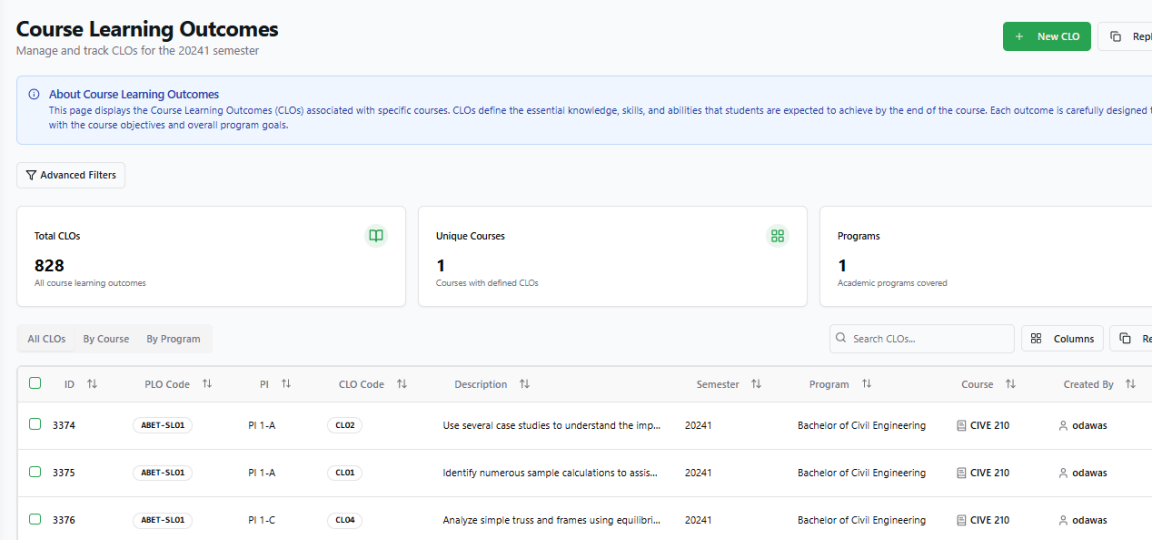


Figure 28: The Portal system for creating the CLOs

Upon completing the CLO entry process, instructors can:

- **Download** the finalized mapping report and weight distribution from the system
- **Modify** existing CLOs as needed, including:
- Adjusting CLO descriptions
- **Updating** alignments with program (PLO) or NCAAA standards
- **Revising** weight distributions for SLO/PLO contributions

As demonstrated in Figure 29, this editing interface allows for comprehensive adjustments to ensure accurate outcome representation and alignment.

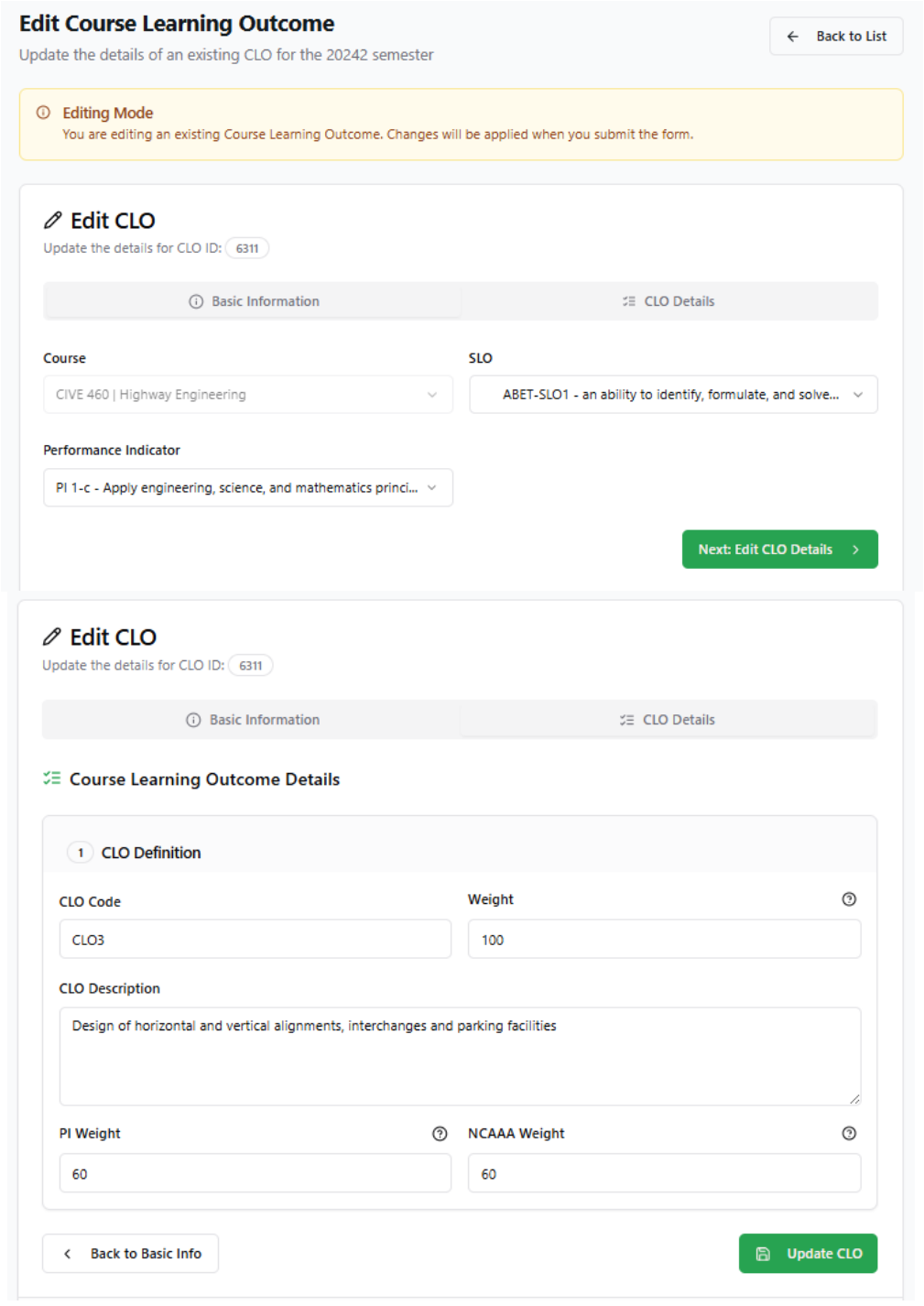


Figure 29: Course learning outcome editor

9.3 Direct Assessment Method Implementation in the Portal System

The assessment process begins with instructors establishing direct assessment methods for their courses through the portal system. Since instructors have already defined the Course Learning Outcomes (CLOs) for each course they teach, they now:

- Select Assessment Tools: Choose one or more appropriate assessment methods for each CLO
- Assign Weightings: Designate the relative contribution of each assessment tool toward evaluating the CLO
- Ensure Alignment: The system automatically aggregates CLO results to reflect their collective impact on the corresponding Program Learning Outcomes (PLOs) and Student Learning Outcomes (SLOs)

Figure 30 illustrates the system interface for generating and configuring these direct assessment methods. The system validates that all weightings sum to 100% for each CLO, ensuring proportional representation in the overall assessment.

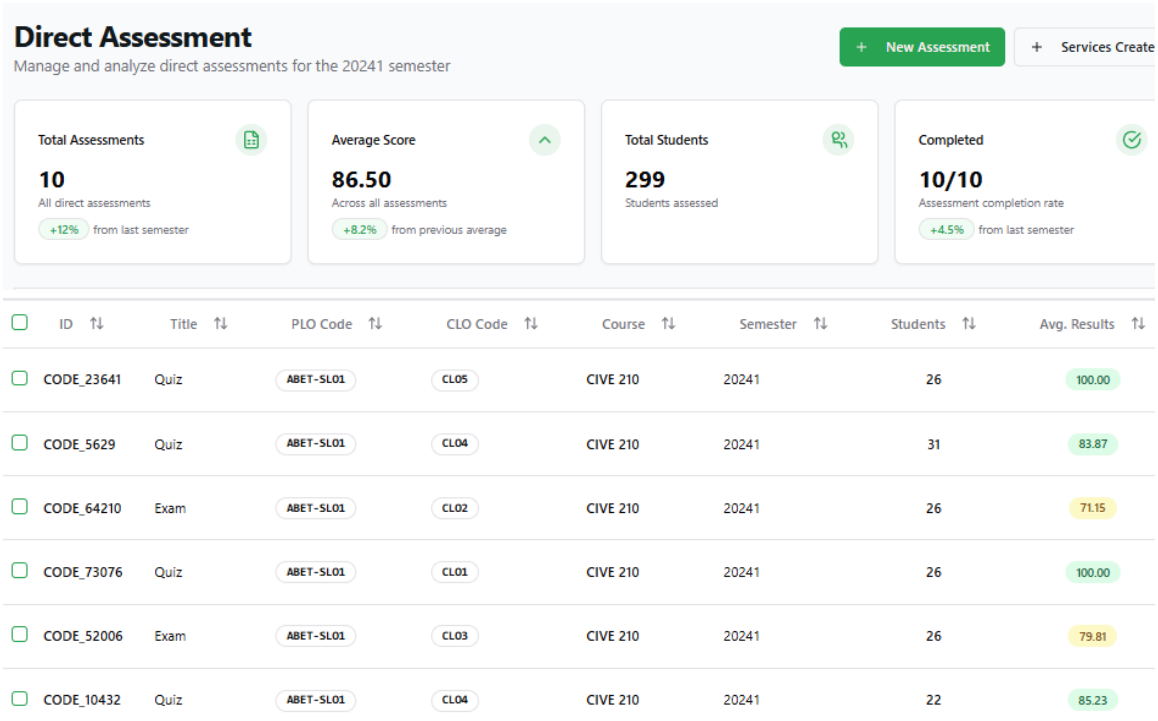


Figure 30: The assessment portal interface for creating the direct assessment tool.

Following the selection of assessment tools, the instructor proceeds with **Student Performance Evaluation and Evidence Submission Process** by:

- Entering individual grades for each student based on the selected assessment method
- Assigning corresponding scores according to established rubrics

- Uploading supporting materials for each student's assessment (e.g., scanned exams, projects, quizzes)
- Ensuring all submissions meet the required documentation standards

As shown in Figure 31, the system interface clearly supports:

- Simultaneous grade entry and evidence attachment
- Secure submission for review and approval by moderators
- Organized tracking of all assessment artifacts

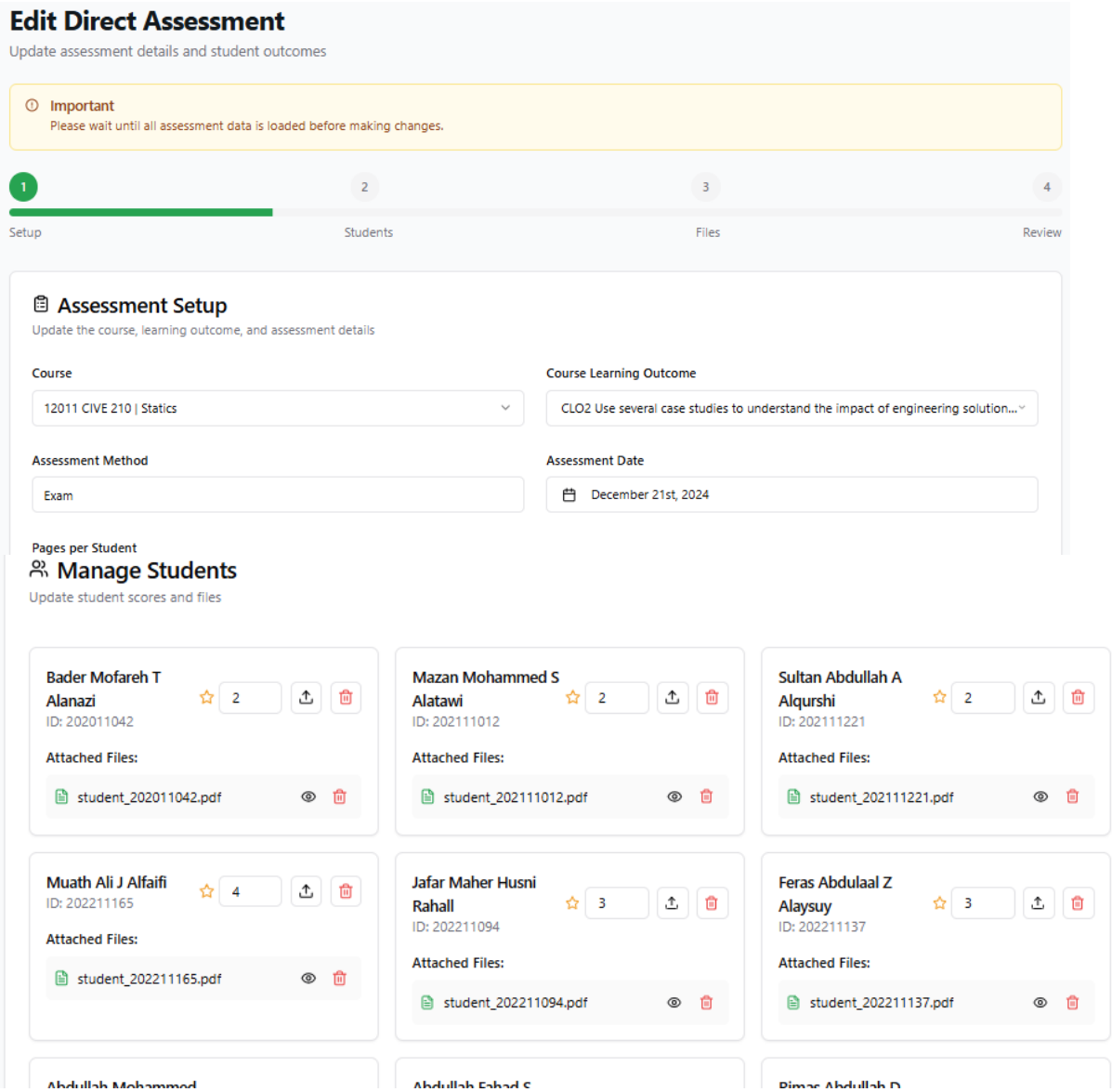


Figure 31: The assessment portal interface for entering the evaluation and evidence of student work

The instructor of the course can perform an Assessment Review and Reporting Process in twofold:

9.3.1 ASSESSMENT EDITING & RESUBMISSION

- Instructors can modify scores and adjust assessments if errors are identified
- Updated results can be resubmitted to the system for final storage
- This review and correction process is illustrated in Figure 32

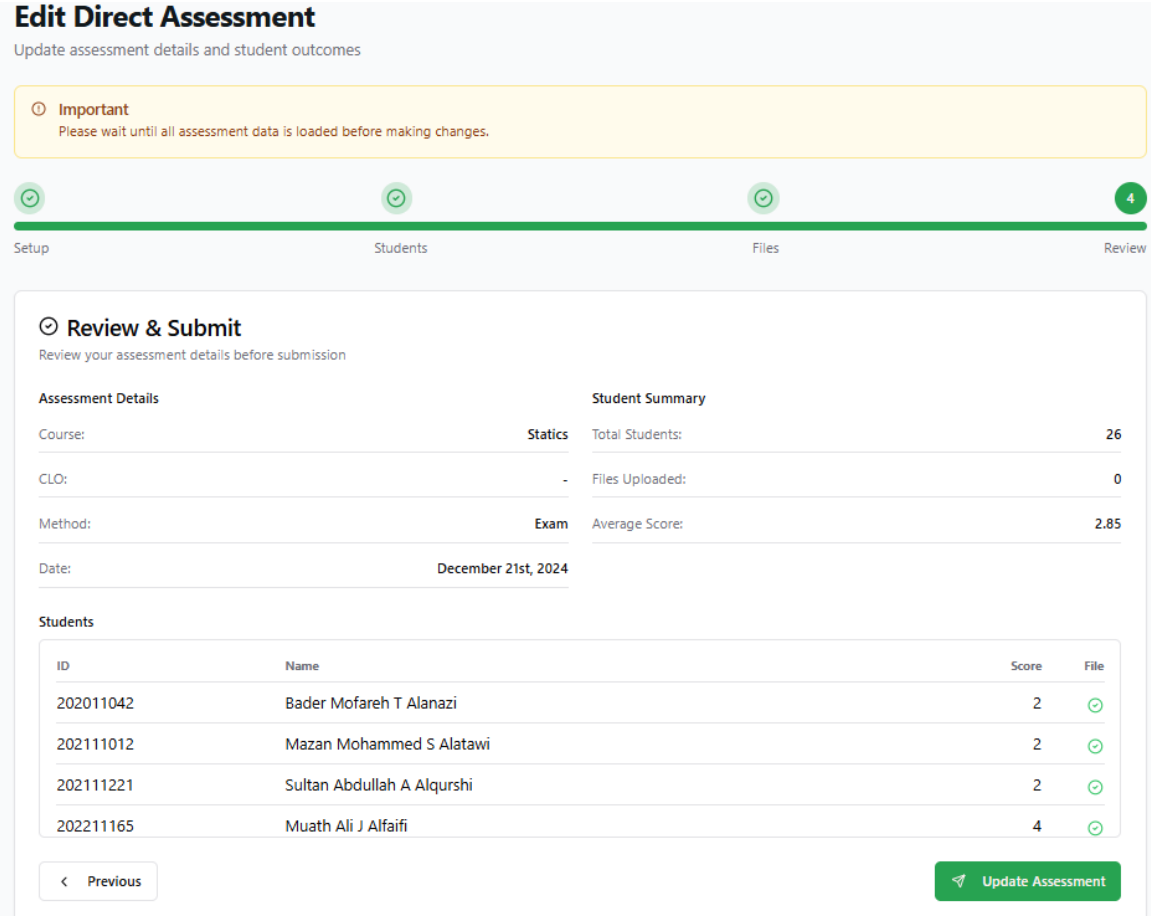


Figure 32: This review and correction process interface at the portal system

System Storage & Reporting

- The system automatically:
- Calculates average results for each CLO
- Stores all assessment files and evidence
- Instructors can download a comprehensive Excel report containing:
- Summary of all assessment results (Figure 33)
- Detailed student score breakdowns (multiple sheets)
- Downloadable links to each student's assessment evidence (Figure 34)

Fahad Bin Sultan University

Engineering

Civil Engineering

Embedded Assignment

Student Evaluation

Input Form

Performance Measure: CIVE 210 CLO1

CLO1 : Identify numerous sample calculations to assist the students in the application of equations, charts, and tabulated data

Subject:	CIVE	Course Title:	Statics
Course Id:	210	Designation:	Civil Engineering
Course Hours:	3	Offering Semester:	20241
Section Id:	21	No. of registered students:	25

Assessed method used (Exam, Homework, Quiz,…):		Quiz	
Number of assessed students:	61	Assessment date:	2024-11-11
Assessor Name:	Osama Al Dawas		

Summary of Student Results

Performance Measure	Number of Students scoring 1	Number of Students scoring 2	Number of Students scoring 3	Number of Students scoring 4
CIVE 210 CLO1	***0***	***2***	***0***	***33***

AVG=	97.14 %

Comments and proposed improvements, if any.

Student Id:	Student Name:	Student Score:
202111007	Samee Kaled T Alutabee	2
202111190	Essa Mohaamed M Alnajrani	4
202211037	Mohammed Khalid D ALjohani	4
202211072	Abdulhadi Hulayyil F Alsharari	4
202215034	Nada Ali M Alsayed	4
202215055	Arwa Aqeel A Hushaybiri	4
202311042	Muath Mohammad Alfigawi	4
202311052	Khlid Ali S Alatawi	4
202311070	Abdulrahman Bashar Abdelaziz Alfigawi	4
202311097	Mohamed Ahmed A Abdalla	4
202311133	Saad Dhafer D Alsubaie	4
202311138	Omar Mohammed O Albalawi	4
202311140	Yousef Faleh N Albalawi	4

Figure 33: Summary of all assessment results for specific assessment tools

Summary of all assessment results for specific assessment tool (quiz, exam…..etc.)

	Fahad Bin Sultan University					
	Engineering					
	Civil Engineering					
	Embedded Assignment					
	Student Evaluation					
	Input Form					
Performance Measure:	**CIVE 210 CLO1**					
CLO1 : Identify numerous sample calculations to assist the students in the application of equations, charts, and tabulated data						
Course Code:	**CIVE 210**	Course Title:	**Statics**			
Student Id:	**202111007**	Student Name:	**Samee Kaled T Alutabee**			
Performance Measure		**Poor 1**	**Fair 2**	**Good 3**	**Excellent 4**	**Score**
CIVE 210 CLO1		Sample shows little ability to achieve the performance measure	Sample shows little ability to achieve the performance measure	Sample shows little ability to achieve the performance measure	Sample shows an ability to achieve the performance measure	2
CLO1 Identify numerous sample calculations to assist the students in the application of equations, charts, and tabulated data						
Assessor Name:	Osama Al Dawas					

Evidence

Download Assessment

Figure 34: Student's assessment results and score with Downloadable evidences

9.3.2 PROGRAM-LEVEL ASSESSMENT REPORTING

Following the completion of course assessments for the semester, The Program Chair/Coordinator gains exclusive access to:

- Comprehensive program assessment results
- Aggregated data for all Student Learning Outcomes (SLOs)
- Performance Indicators (PIs) and Program Learning Outcomes (PLOs)

Results are automatically compiled in a downloadable Excel format. To access, users must select "Direct Program Assessment Results" (Figure 35). The interface for this function is shown in Figure 36.

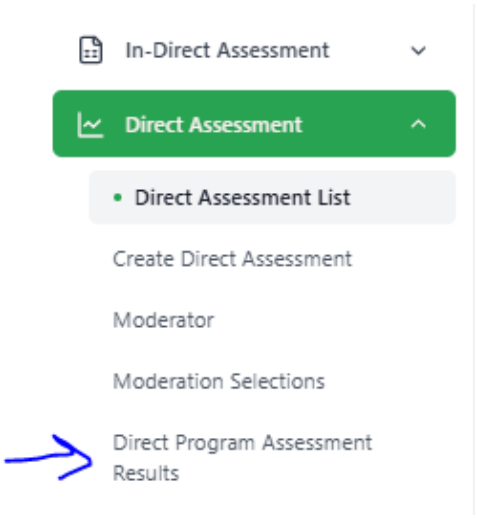


Figure 35: Access the Direct Program Assessment results

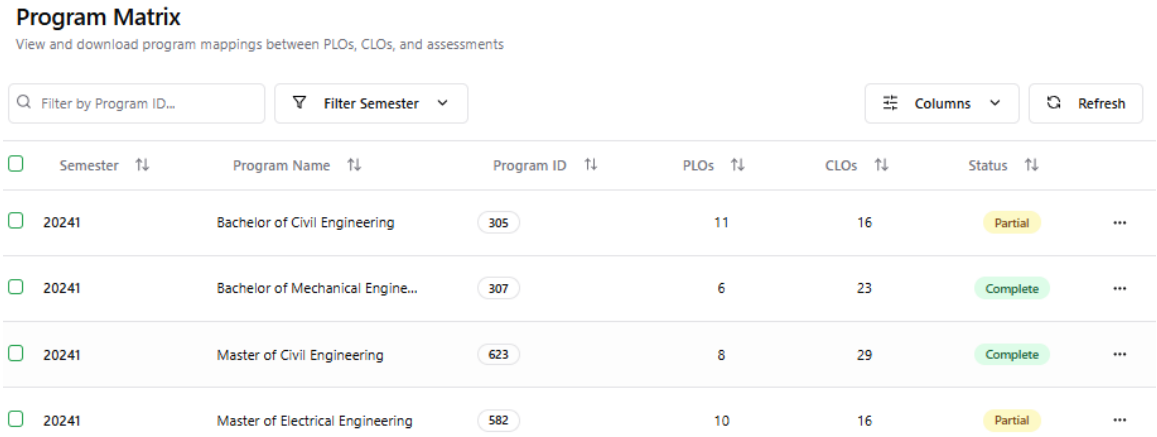


Figure 36: Direct Program Assessment method results for in the portal

Once the assessment of all courses in the semester is collected, the system generates a comprehensive Excel file containing:

- Detailed evaluation scores for each PI/SLO/PLO
- Course-specific contributions to program outcomes
- Weighted average calculations across all assessments

➢ Program Performance Evaluation

The Program Chair can:

- Review quantitative achievement levels for all student outcomes
- Analyze semester-specific program performance trends
- Draw data-informed conclusions about educational effectiveness

- **Report Structure (as shown in Figure 38)**

  Each row displays**:**

  - Course-specific evaluation scores
  - Quantified contributions to relevant PIs/SLOs/PLOs

- **The final row presents:**

  - Overall weighted average score for program outcomes
  - Sample data from the Civil Engineering program illustrates this format

- **Institutional Application**

  - Identical reports can be generated for all assessed programs
  - Supports cross-program comparison and institutional benchmarking

It is seen that in the excel file (Figure 37) the SLO7-PI7-PLO (S4) is not evaluated yet in this semester and need to be followed up.

CourseID	Direct Assessemnt Results for Civil Engineering Program Fall 2024-2025												
ABET	ABET-SLO1			ABET-SLO2		ABET-SLO3	ABET-SLO4		ABET-SLO5		ABET-SLO6		ABET-SLO7
PI	PI 1-a	PI 1-b	PI 1-c	PI 2-a	PI 2-b	PI 3	PI 4-a	PI 4-b	PI 5-a	PI 5-b	PI 6-a	PI 6-b	PI 7
NCAAA	K1	K2	S1	S3	S3	S5	V1	K3	V2	V2	S2	S2	S4
CIVE 210 - Statics	85.58		88.29										
CIVE 211 - Structural Mech	73.17		85.47										
CIVE 220 - Engineering Ma													
CIVE 240 - Fluid Mechanic	72.64		76.47										
CIVE 250 - Environmental E	65.31			61.21									
CIVE 260 - Spatial Measure													
CIVE 310 - Structural Analy													
CIVE 320 - Concrete I	92.84		85.34										
COEN 300 - Engineering Ec		88.59			72.19			85.29					
CSC 100 - Introduction to C													
CIVE 330 - Geotechnical Er													
CIVE 351 - Water and Was	89.47			87.50	76.39								
CIVE 360 - Transportation	72.81		66.53										
CIVE 430 - Foundation Eng													
CIVE 460 - Highway Engine	77.29		74.48										
CIVE 480 - Construction M	90.63		79.63										
CIVE 461 - Pavement Desig	72.57		82.50	82.69									
PHYS 102 - General Physic													
CHEM 101 - General Chem	81.15	93.75	79.55										
CHEM 101L - General Che	93.11		95.83										
MATH 101 - Calculus I	100.00		77.50										
MATH 102 - Calculus II													
MATH 201 - Calculus and A													
MATH 202 - Differential Ec	100.00		59.98										
MATH 215 - Linear Algebra			75.00										
PHYS 101 - General Physic													
PHYS 101L - General Physi													
PHYS 102L - General Physi													
STAT 230 - Probability and	100.00	91.67											
ENGL 102 - Basic Academi						71.11							
SOCS 101 - Islamic Civiliza													
SOCS 201 - Islamic Civiliza													
ARAB 101 - Basic Academi													
ARAB 201 - Advanced Acad													
SOCS 202 - World Civilizati													
ENGL 203 - Advanced Acad						52.50							
ENGL 206 - Technical Writ						73.81	100.00						
ENGL 101 - Basic Academi													
CIVE 412 - Steel Design	68.88		79.17										
CIVE 205 - Engineering Dra	78.95									77.50			
CIVE 215 - Computer Aided	75.00					79.84							
CSC 101 - Introduction to C	92.20					79.17			100.00				
PHYS 103L - Physics Lab													
CIVE 471 - Quantity Survey	79.55		73.06										
CIVE 472 - Contracts and S													
SOCS 203 - History of the K													
IT 100 - Information Techn													
ENGL 100 - General Englis						82.89							
MATH 100 - Mathematics	92.86												
STAT 100 - Introduction to	84.38												
PHE 101 - Physical and He													
ELEE 230 - Programming fo		93.55	91.96									91.13	
CIVE 400 - Summer Interns													
CIVE 410 - Structural Analy													
CIVE 498 - Final Year Proje													
CIVE 499 - Final Year Proje													
COEN 401 - Communicatio						98.77	84.70	97.50					
CIVE 220L - Engineering M											100.00		
CIVE 240L - Fluid Lab											45.00		
CIVE 330L - Geotechnical E											53.13		
CIVE 260L - Surveying Lab											100.00		
PI AveragesPI Averages	83.56	91.89	79.42	77.68	73.92	75.53	92.35	90.32	100	77.5	74.53	91.13	

Figure 37: Program Performance Evaluation Scores for Direct assessment method

The system provides advanced analytical capabilities to support program evaluation:

- **Course Contribution Analysis (Figure 38)**
  - Visualizes how individual courses contribute to the assessment of specific Performance Indicators (PIs)
  - Demonstrates alignment patterns between courses and program/student learning outcomes (PLOs/SLOs)

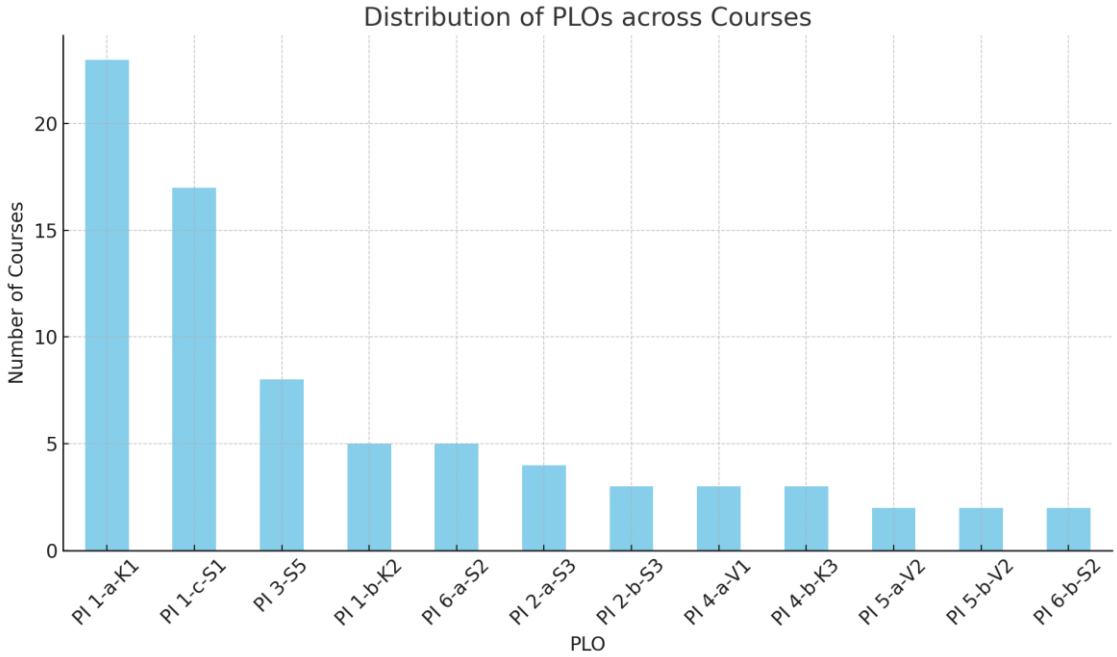


Figure 38: Number of courses contribution in assessments of the student outcomes

- **Final Performance Metrics (Figure 39)**
  - Presents consolidated achievement scores for all PIs
  - Shows outcome attainment levels relative to PLOs and Relevant SLOs
  - Enables holistic review of program effectiveness

These analytical tools allow for:

- Identification of strong and weak performance areas
- Data-driven curriculum improvement decisions
- Accreditation documentation support

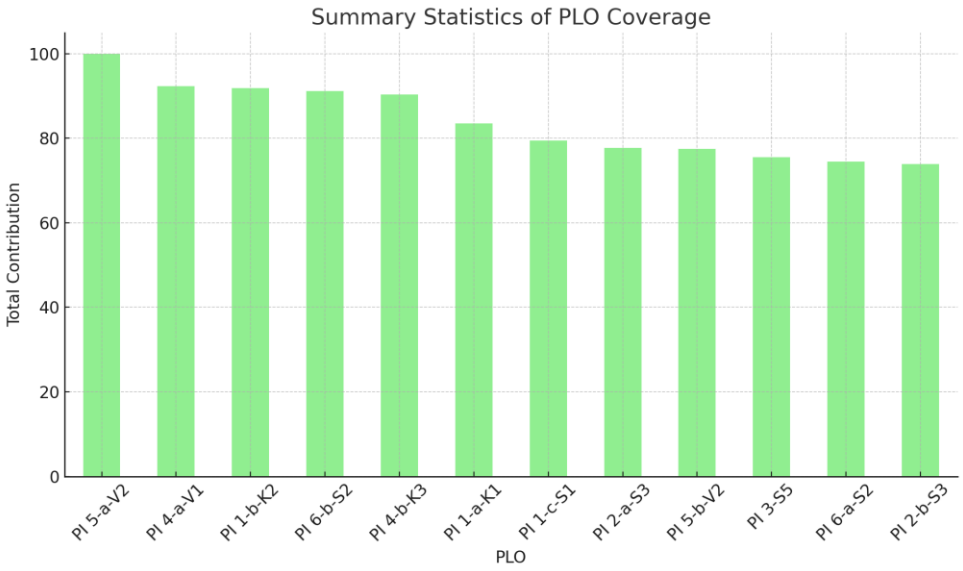


Figure 39: Total average evolution cores for the student outcomes

9.4 Indirect Assessment Method Implementation in the Portal System

While indirect assessment methods (e.g., student surveys) are equally valuable as direct assessment tools, they typically carry a lower weight in overall program evaluation. The assessment portal system supports this process through the following workflow:

➢ Accessing Indirect Assessment

- Instructors or program chairs navigate to the dedicated indirect assessment page (Figure 40)

➢ Survey Design Process

- Select the course for indirect evaluation
- Develop survey questions that:
  - Align with specific Course Learning Outcomes (CLOs)
  - Include weighted contributions for each question-CLO pairing
- Ensure comprehensive coverage of all CLOs

This structured approach maintains academic rigor while capturing valuable student feedback for continuous improvement.

➢ Student Survey Administration Process

1. **Survey Deployment**
   - After the instructor enters the questionnaire items into the system, a unique survey link is automatically generated

- This link becomes accessible to students during a predefined period, typically during the final weeks of the semester

2. **Student Feedback Collection**
   - Students complete the structured assessment questions
   - The survey includes open-ended sections allowing students to:
     - Comment on course objectives and delivery methods
     - Reflect on learning outcome achievement
     - Provide constructive suggestions for course improvement
3. **System Features**
   - Automated distribution and reminder system
   - Secure submission process
   - Anonymous response options (if configured)

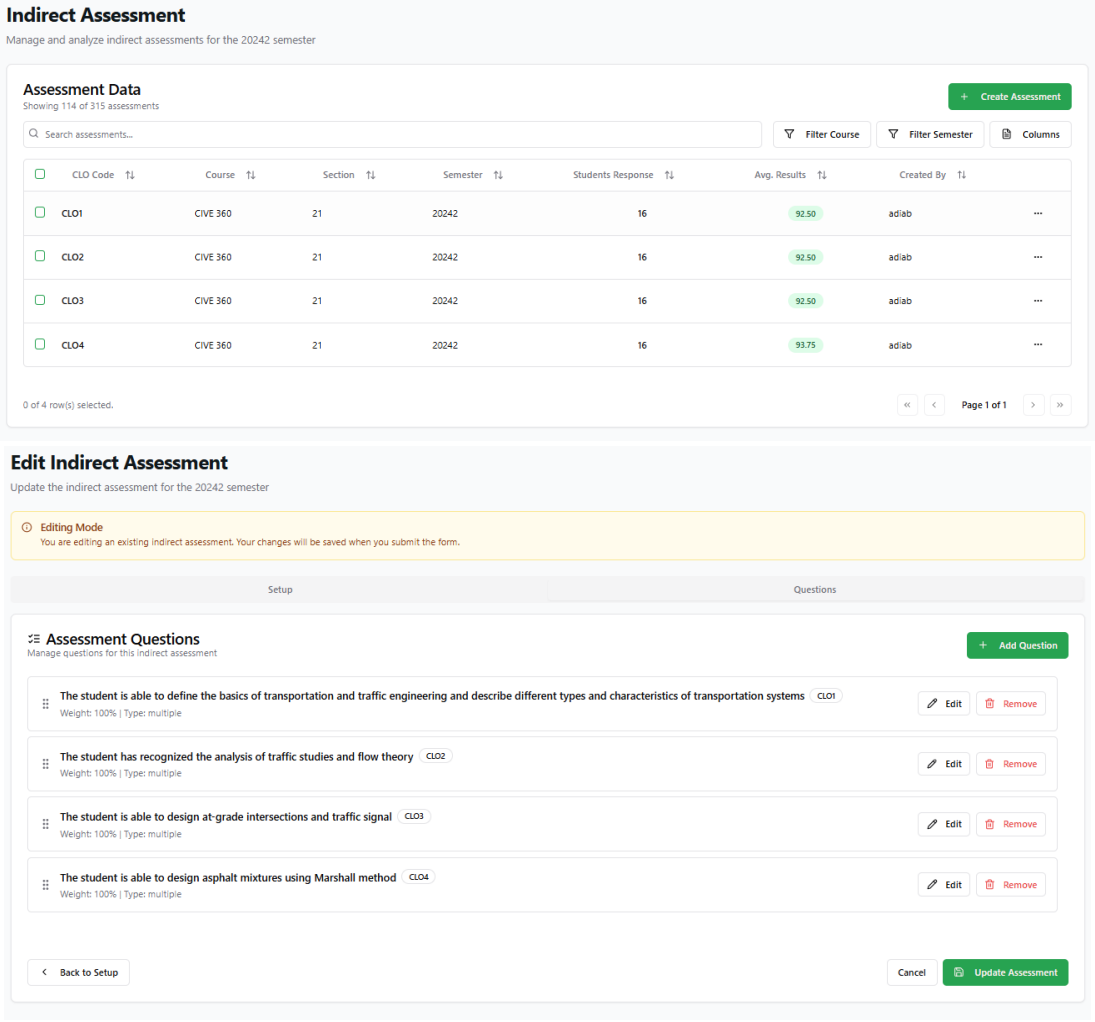


Figure 40: The indirect assessment portal system

9.4.1 PROGRAM-LEVEL INDIRECT ASSESSMENT REPORTING

Following the closure of student surveys for the semester, the Program Chair/Coordinator gains access to:

- Aggregated indirect assessment results from all course evaluations
- Comparative analysis of student-perceived outcome achievement (SLOs/PLOs)
- Qualitative feedback trends across program courses

Results are compiled in a downloadable Excel format accessed via **"Indirect Program Assessment Results"**

Student survey results dashboard in the portal will generate for each CLO assessment an excel sheet that can be downloaded Once all course surveys are completed, the system generates:

- Student perception scores for each aligned PI/SLO/PLO
- Thematic analysis of open-ended feedback
- Benchmarking against direct assessment results

Figure 41 presents the summary results of the indirect assessment for CLO1 in the Civil Engineering course. The achieved evaluation score of 87.2% (exceeding the 70% benchmark) indicates successful attainment of this learning outcome. The accompanying Excel file includes multiple sheets detailing:

- Performance breakdown for each survey question
- Student response distributions (Figure 42)

The Program Chair can leverage this data to:

- Compare student perceptions with direct assessment results to identify discrepancies
- Monitor long-term satisfaction trends across semesters
- Identify courses requiring instructional improvements

The Chair also accesses consolidated indirect assessment results for all courses, presented in a structured Excel format similar to Figure 42 but focused on indirect data. Key features include:

- Course-specific metrics for all CLOs
- Data triangulation – Combines indirect and direct evidence for robust program evaluation
- Accreditation support – Documents student feedback for quality assurance reviews

Fahad Bin Sultan University

Engineering

Civil Engineering

Embedded Assignment

Student Evaluation

Performance Measure: CIVE 460 CLO1

CLO1 : Understand the basic principles of highway design geometry and route survey

Subject:	CIVE 460	Course Title:	Highway Engineering
Course Id:		Designation:	Civil Engineering
Course Hours:	3	Offering Semester:	20241
Section Id:	21	No. of registered students:	26

Assessed method used (Exam, Homework, Quiz,…):		title	
Number of assessed students:	25	Assessment date:	date assessed
Assessor Name:	Diab		

Summary of Student Results

Performance Measure	Number of Students scoring 1	Number of Students scoring 2	Number of Students scoring 3	Number of Students scoring 4	Number of Students scoring 5
crs_num PLOCode	*1*	*0*	*5*	*2*	*17*

AVG=	87.2 %

Comments and proposed improvements, if any.

Student Id:	Answer:	Evidence:

Figure 41: Indirect Assessment summary for CLO1 in CIVE 460

FBSU's assessment system incorporates multiple indirect evaluation methods, all of which contribute to accreditation documentation and continuous program improvement. While course evaluation surveys (discussed previously) remain foundational, the institution systematically collects additional critical feedback through surveys see Figure 43:

1. **CLO Self-Assessment Surveys**
   - Students evaluate their perceived mastery of each Course Learning Outcome
   - Identifies gaps between instructor assessments and student self-perceptions
2. **Program Exit Surveys**: Graduating students reflect on:
   - Overall program effectiveness
   - Achievement of Program Learning Outcomes
   - Preparation for professional/career next steps

3. **Alumni Surveys (1-5 Years Post-Graduation)** tracks:
   - Career progression outcomes
   - Long-term perceived value of program competencies
   - Suggestions for curriculum modernization
4. **Employer Surveys**: Measures:
   - Graduate workplace performance
   - Program strength/weakness in developing job-ready skills
   - Emerging industry needs for curriculum alignment

Automated distribution to target populations (students/alumni/employers). Responses are systematically analyzed and integrated into Annual program assessment reports PLO/IL achievement documentation Curriculum review cycles.

Fahad Bin Sultan University

Civil Engineering

Civil Engineering

Embedded Assignment

Student Evaluation

Input Form

Performance Measure: CIVE 460 CLO2

CLO2 : Understand highway earthwork, soil tests and Superpave mix design for highway projects

Subject:	CIVE 460	Course Title:	Highway Engineering
Course Id:		Designation:	Civil Engineering
Course Hours:	3	Offering Semester:	20241
Section Id:	21	No. of registered students:	26
Assessed method used (Exam, Homework, Quiz,…):		Survey	
Number of assessed students:	25	Assessment date:	date assessed
Assessor Name:	created_by		

Summary of Student Results

Performance Measure	Number of Students scoring 1	Number of Students scoring 2	Number of Students scoring 3	Number of Students scoring 4	Number of Students scoring 5
crs_num PLOCode	*1*	*1*	*5*	*3*	*15*

AVG=	84 %

Comments and proposed improvements, if any.

Student Id:	Answer:	Evidence:
1	5	Download Assessment
2	3	Download Assessment
3	5	Download Assessment
4	2	Download Assessment

Figure 42: Sample of embedded sheet in the indirect assessment results file

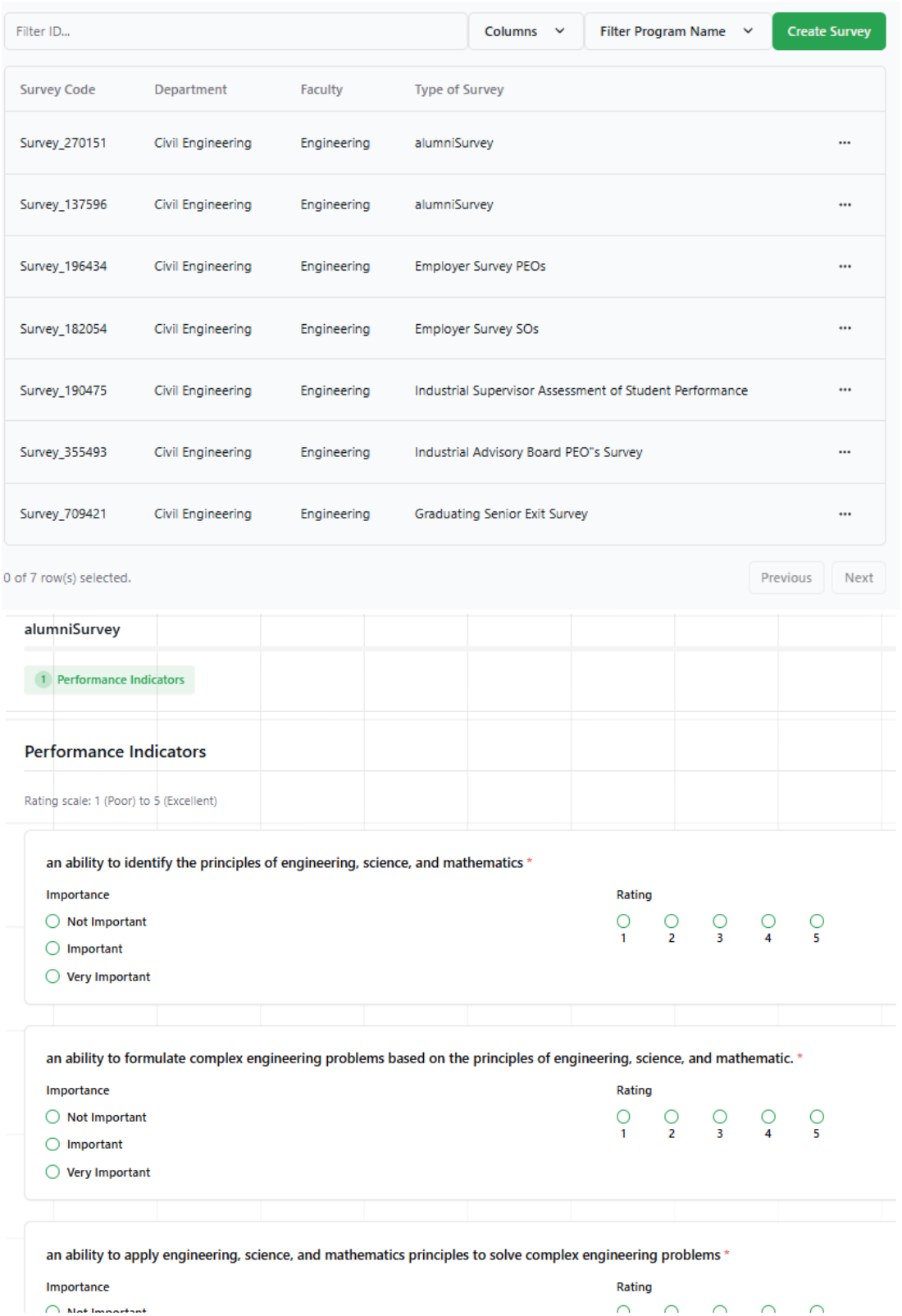


Figure 43: Indirect assessment Surveys for several constituents and partners

10. Conclusion

Effective implementation of assessment is essential for ensuring that academic programs at FBSU meet national and international accreditation requirements and continuously improve the quality of education. The guidelines provided in this section offer a framework for implementing assessment in a systematic, sustainable, and meaningful way.

By following these guidelines, faculty and administrators can develop assessment processes that not only satisfy accreditation requirements but also enhance student learning and program quality. The emphasis on continuous improvement ensures that assessment is not merely a compliance exercise but a valuable tool for advancing engineering education at FBSU.

The success of assessment implementation depends on the commitment and collaboration of all stakeholders, including faculty, administrators, students, and industry partners. By working together and maintaining a focus on student learning, FBSU can create a culture of assessment that supports its mission of providing quality education to the highest international standards.

11. Glossary of Terms

Term	Definition
CLO	Course Learning Outcome - A statement that describes what students should know and be able to do upon successful completion of a course.
PLO	Program Learning Outcome - A statement that describes what students should know and be able to do upon successful completion of a program.
SLO	Student Learning Outcome - ABET's term for program learning outcomes, specifically the seven outcomes required for all engineering programs.
PEO	Program Educational Objective - Broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve within a few years after graduation.
Direct Assessment	Methods that evaluate student learning by examining samples of student work or performances.
Indirect Assessment	Methods that evaluate student learning by gathering information through means other than direct examination of student work.
Rubric	A scoring tool that explicitly represents the performance expectations for an assignment or piece of work.
Curriculum Map	A matrix that shows the relationship between program courses and program learning outcomes.
Closing the Loop	The process of using assessment results to inform decisions about program improvements.

Section VI

Institutional Learning Outcomes (ILOs)

1. Introduction

Fahad Bin Sultan University (FBSU) concerning the establishment, assessment, and continuous improvement of its Institution Learning Outcomes (ILOs). Recognizing the critical role of clearly defined and rigorously assessed learning outcomes in ensuring academic quality and relevance. The Institution adheres to the standards set by its target accreditation body, the NCAAA and international accreditations bodies, in developing its Institutional Learning Outcomes (ILOs). These ILOs are aligned with the Institution's mission statement and serve as the foundation for all Program Learning Outcomes (PLOs) and General Education Course Learning Outcomes (CLOs), ensuring consistency across all academic offerings.

Core Competencies (also referred to as Graduate Attributes) and Institutional Learning Outcomes represent the essential skills and abilities students are expected to acquire by the time they graduate, regardless of their field of study. Below are the recommended Core Competencies and Institutional Learning Outcomes for Prince Sultan University.

The methodology involved a thorough analysis of the FBSU's approach to defining core competencies, establishing ILOs, detailing assessment processes (including the PIMRU model: Planning, Implementing, Monitoring, Reviewing, and Updating), and outlining reporting requirements.

2. Understanding Institution Learning Outcomes (ILOs) – A Framework

2.1 Defining Core Competencies and ILOs

Institution Learning Outcomes (ILOs) are explicit statements describing what students are expected to know, understand, and be able to do upon completion of their program of study. They represent the desired attributes and capabilities of a graduate, the abilities and skills students should develop by graduation, irrespective of their specific academic discipline. These are broad, overarching goals that guide curriculum development, teaching practices, and assessment strategies across the institution.

For FBSU, adopting a similar definition would mean articulating a set of high-level competencies that all its graduates should possess. These might include, but are not limited to:

- **Knowledge and Understanding:** Demonstrating comprehensive mastery of their chosen field and a broad understanding of general education principles.
- **Critical Thinking and Problem Solving:** The ability to analyze complex issues, think reflectively, and devise creative and innovative solutions.
- **Leadership and Lifelong Learning:** Displaying initiative, integrity, entrepreneurial skills, and a commitment to continuous personal and professional development, contributing positively to society.

- **Communication and Teamwork:** Articulating ideas effectively in both oral and written forms and collaborating productively with others to achieve common goals.
- **Digital Literacy:** Demonstrating proficiency in using a wide range of technological tools and strategies to enhance problem-solving and adaptability.
- **Social Responsibility and Ethical Conduct:** Acting responsibly in personal and professional contexts, engaging ethically with the community, and upholding high moral standards.
- These categories were used by FBSU to establish its own distinct set of Institutional Learning Outcomes (ILOs), ensuring alignment with the institution's core values and stakeholder expectations (Table 9).

Table 9: Institutional Learning Outcome and NQF Learning Areas

FBSU - University Graduate Attributes			
Graduate Attributes	**NQF**	**ILOs**	
1) Deep Discipline Knowledge and Capability	*Knowledge and Understanding*	1.1)	Possess deep discipline knowledge in the field of specialty combined with contemporary pedagogical approaches and research methods to implement such knowledge.
		1.2)	Demonstrate knowledge and comprehension of the concepts, techniques and practices they have gained.
2) Creative and Critical Thinking	*Skills*	2.1)	Think creatively and critically and be capable of providing sound and innovative solutions to academic and work-based challenges.
3) Digital Capability		2.2)	Be able to adapt to and use the latest technological advancement to better serve their stakeholders and improve their own careers.
4) Communication Skills		2.3)	Be able to convey their ideas and communicate effectively with colleagues, stakeholders and society at large.
5) Moral and Ethical Awareness	*Values*	3.1)	Exercise professional and ethical standards in their careers, workplace and community.
6) Self-Directed Learning and Team Work Leadership		3.2)	Demonstrate ability to perform career-related tasks professionally with autonomy and as a team member or leader while retaining a resilient passion for lifelong learning.
7) Social Responsibility		3.3)	Provide a significant and positive contribution to the development of their workplace performance and community involvement

2.2 Alignment of ILOs with Institutional Mission and National Frameworks

A crucial aspect of developing effective ILOs is ensuring their alignment with the university's overarching mission and vision, as well as with relevant national educational frameworks, such as the National Qualifications Framework (NQF) in Saudi Arabia in the NCAAA (National Commission for Academic Accreditation and Assessment) guidelines.

For FBSU, this would involve a careful review of its mission statement. The ILOs should directly reflect and support these mission elements. For example, if FBSU's mission includes fostering innovation, then specific ILOs should address creative problem-solving, entrepreneurial thinking, or the application of cutting-edge technologies.

Alignment with the Saudi NQF is also paramount. The NQF typically outlines domains of learning (e.g., Knowledge, Skills, and Values/Competence) and levels of achievement. FBSU's Institutional **Learning Outcomes (ILOs)** are designed to align with both the university's **mission and core values** and the **National Qualifications Framework (NQF)**. This dual alignment ensures that graduates meet institutional expectations while also fulfilling national educational standards, enhancing employability and societal contribution. This alignment not only ensures regulatory compliance but also enhances the credibility and portability of FBSU qualifications. Table 10 illustrates the alignment and mapping relationships for these entities.

Table 10: ILO Alignment Matrix

Institutional Learning Outcome	Mission Alignment	Core Value Supported	NQF Domain & Level
Possess deep discipline knowledge in the field of specialty combined with contemporary pedagogical approaches and research methods to implement such knowledge.	"Providing high quality education" "Fostering scientific research"	Academic and Personal Integrity	Knowledge (Level 7-8) Research Skills (Level 8)
Demonstrate knowledge and comprehension of the concepts, techniques and practices they have gained.	"High quality education" "Life-long learning"	Lifelong Learning	Applied Knowledge (Level 6-7)
Think creatively and critically and be capable of providing sound and innovative solutions to academic and work-based challenges.	"Fostering... creativity" "Scientific research"	Inclusion and Respect Pluralism of Opinions and Ideas	Cognitive Skills (Level 7) Problem Solving (Level 7-8)
Be able to adapt to and use the latest technological advancement	"High quality education"	Lifelong Learning Accountability	Digital Literacy (Level 5-7) Technology

to better serve their stakeholders and improve their own careers.		and Transparency	Application (Level 6)
Be able to convey their ideas and communicate effectively with colleagues, stakeholders and society at large.	"Community engagement"	Teamwork and Collaboration Equal Opportunities and Respect for Diversity	Communication (Level 6-7) Interpersonal Skills (Level 6)
Exercise professional and ethical standards in their careers, workplace and community.	"Ethical conduct, integrity"	Academic and Personal Integrity Accountability and Transparency	Professional Ethics (Level 7-8) Autonomy (Level 7)
Demonstrate ability to perform career-related tasks professionally with autonomy and as a team member or leader while retaining a resilient passion for lifelong learning.	"Life-long learning" "Community engagement"	Teamwork and Collaboration Lifelong Learning	Leadership (Level 7-8) Self-Management (Level 7)
Provide a significant and positive contribution to the development of their workplace performance and community involvement.	"Community engagement"	Community Engagement Equal Opportunities and Respect for Diversity	Social Responsibility (Level 7-8) Civic Engagement (Level 7)

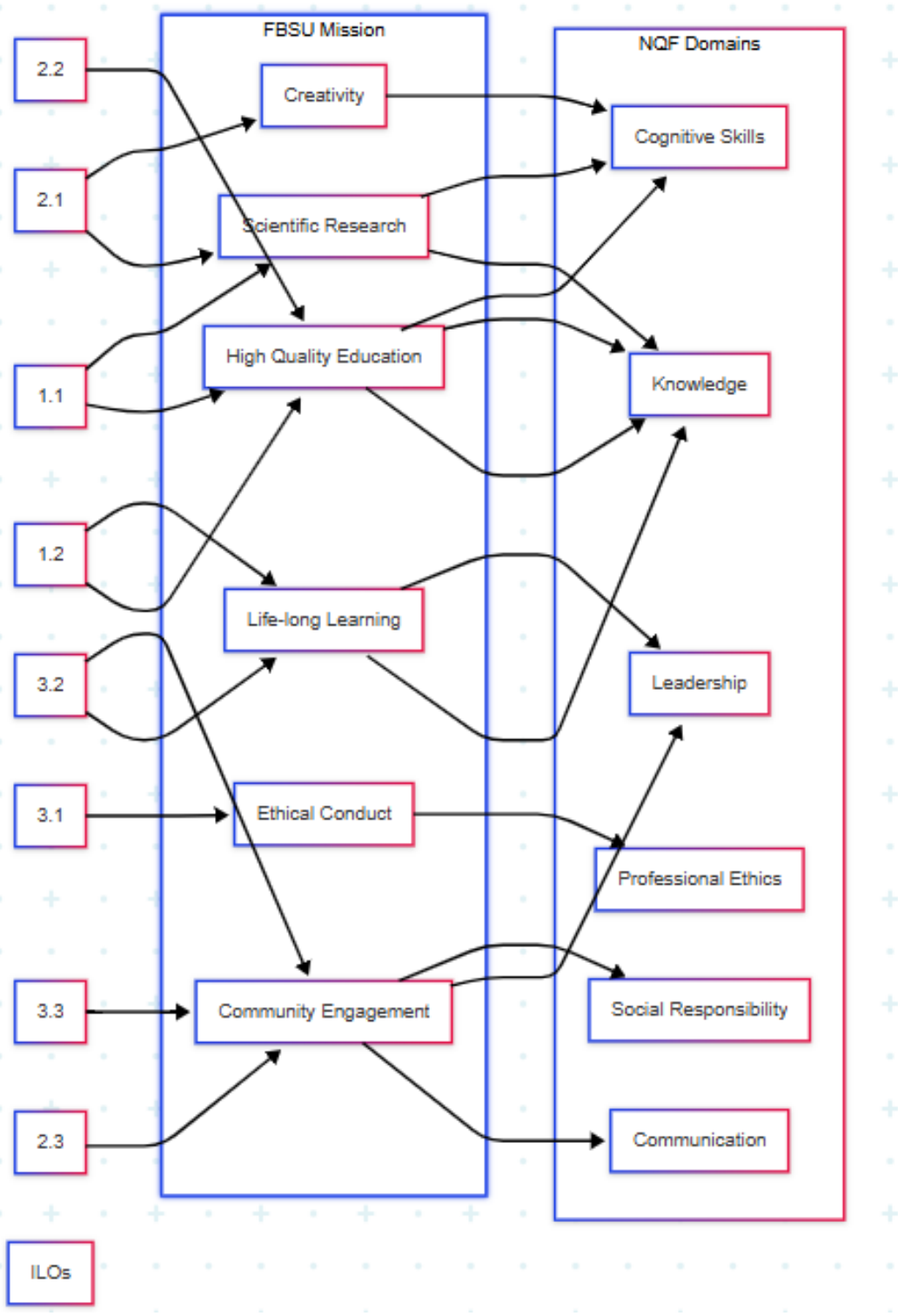


Figure 44: The mapping chart for ILs to FBSU's Mission and the NQF

3. Proposed ILO Assessment Process for FBSU (PIMRU Model)

FBSU's Institutional Learning Outcomes (ILOs) are structured according to the **three NQF learning domains**, ensuring comprehensive graduate development:

NQF Domain	FBSU ILOs	Alignment with Mission/Values
Knowledge & Understanding	1.1 Possess deep discipline knowledge with contemporary pedagogical approaches 1.2 Demonstrate mastery of concepts and practices	High-quality education Scientific research Academic Integrity
Skills	2.1 Think creatively and critically to solve challenges 2.2 Adapt to technological advancements 2.3 Communicate effectively	Creativity Lifelong learning Teamwork & Collaboration
Values	3.1 Uphold professional and ethical standards 3.2 Lead with autonomy and teamwork 3.3 Contribute to community development	Ethical conduct Community engagement Respect for diversity

The various phases covered under the PIMRU model for Institutional Learning Outcome Assessment Process are shown below:

3.1 Planning Phase

Effective assessment begins with meticulous planning. This phase is foundational and involves several key steps for FBSU to consider:

1) Developing/Reviewing FBSU ILOs

   The first step is the formal development or review of FBSU's Institution Learning Outcomes. These ILOs must be clearly articulated, concise, and reflect the university's mission, the needs of its students and stakeholders, and alignment with national standards (e.g., NQF, NCAAA requirements). This process should involve broad consultation with faculty, academic leaders, students, alumni, and potentially employers. If ILOs already exist, they should be periodically reviewed for currency and relevance.

2) Mapping Program Learning Outcomes (PLOs) to ILOs

Once the institutional ILOs are established, each academic program at FBSU should map its specific Program Learning Outcomes (PLOs) to these overarching ILOs. This mapping exercise demonstrates how each program contributes to the achievement of the broader institutional goals. It ensures that the curriculum and learning experiences within each program are designed to foster the development of the desired institutional attributes in graduates. This mapping should be documented and regularly reviewed.

3) Mapping General Education Courses to ILOs

   Similarly, General Education courses, which form a common core for many students, play a vital role in developing institutional competencies. The learning outcomes of these courses (Course Learning Outcomes - CLOs) should also be explicitly mapped to the FBSU ILOs. This ensures that the foundational knowledge and skills imparted through general education contribute directly to the achievement of the institution-wide learning goals.

4) Establishing an ILO Assessment Plan and Timelines

   FBSU should develop a systematic, multi-year ILO assessment plan. It is often practical to assess a subset of ILOs each year, ensuring that all ILOs are assessed over a defined cycle (e.g., 2-4 years). The plan should specify:

   - Which ILOs will be assessed in which academic year
   - The courses (both program-specific and general education) that will be involved in the assessment of each ILO.
   - The assessment methods and instruments to be used (both direct and indirect).
   - The timeline for data collection, analysis, and reporting.
   - The individuals or committees responsible for overseeing the assessment of each ILO.

   This plan provides a clear roadmap for the assessment activities and ensures that the process is manageable and sustainable.

5) Setting Target Benchmarks

   For each ILO being assessed, FBSU should establish clear and measurable target benchmarks or performance indicators. These benchmarks define the expected level of student achievement. Targets should be realistic yet challenging and can be informed by historical data, accreditation standards, or peer institution performance. Separate benchmarks might be set for direct and indirect assessment measures. These targets provide a basis for evaluating the effectiveness of educational programs and identifying areas for improvement.

3.2 Implementation Phase

Once the planning is complete, the next phase involves the systematic implementation of the ILO assessment plan:

1) Data Collection using Direct and Indirect Measures

   This is the core of the implementation phase. The approved institutional assessment plan is implemented using direct (such as rubrics) or indirect methods (using course exit surveys/program exit surveys).

2) Aggregation and Analysis of PLO and CLO Results

Data collected from various sources need to be aggregated and analyzed. For direct measures, this means compiling scores from rubrics or assessments for students in the targeted courses or programs. For indirect measures, survey responses would be statistically analyzed. The analysis should focus on determining the extent to which students are achieving the target benchmarks for each ILO.

Academic departments and relevant committees at FBSU are responsible for this aggregation and initial analysis, particularly for PLOs and CLOs that map to the institutional ILOs.

3.3 Reviewing (Auditing) and Updating Phase (Closing the Loop)

Assessment is not an end in itself; its primary purpose is to drive improvement. The PIMRU model's "Reviewing" and "Updating" phases are critical for "closing the loop."

1) Reporting ILO Results and Analysis

   Following data collection and analysis, comprehensive reports on ILO assessment findings should be prepared using:

   - **Course-Level Reports:** Faculty report on CLO achievement, which feeds into PLO and ILO assessment.
   - **Program-Level Reports:** Academic departments prepare annual or cyclical reports on PLO achievement, including how these contribute to ILOs. These reports would detail the assessment methods used, the findings, analysis against benchmarks, and proposed actions.
   - **Institutional ILO Assessment Report:** An institutional body (e.g., an Institutional Assessment Committee) would compile program-level data and direct assessments from general education to produce an overall report on the achievement of FBSU ILOs.
   - This report, will include:
     - The ILOs assessed
     - Performance indicators and target values.
     - Measurement tools and data collection cycles.
     - Assessment findings (quantitative and qualitative).
     - Suggested actions based on the findings.
     - Who is responsible for the actions

   These reports are disseminated to relevant stakeholders, including faculty, academic administrators, and university leadership.

2) Recommending Improvements

Based on the analysis of assessment results, specific, actionable recommendations for improvement should be formulated. These recommendations might target:

- **Curriculum:** Modifications to course content, learning activities, or program structure.
- **Pedagogy:** Changes in teaching methods or instructional strategies.
- **Assessment Methods:** Refinements to assessment tools, rubrics, or the assessment plan itself.
- **Student Support Services:** Enhancements to academic advising, tutoring, or other support mechanisms.
- **Faculty Development:** Providing training or resources to faculty to improve teaching and assessment practices.
- **The ILOs themselves:** Revising ILO statements for clarity or relevance if assessment data suggest they are problematic.

DQAA follows an annual audit session where it will study the recommendations, summarize the issues, observations, and recommendations, and raise a report for major actions to the concerned parties.

3) Documenting the Process

The entire ILO assessment process – from planning to implementation, analysis, reporting, and action planning – must be thoroughly documented. This documentation serves several purposes:

- **Accountability:** Provides evidence of a systematic approach to quality assurance.
- **Transparency:** Allows stakeholders to understand how learning outcomes are assessed and improved.
- **Institutional Memory:** Ensures continuity as personnel change.
- **Accreditation:** Fulfills requirements for national (e.g., NCAAA) and potentially international accreditation bodies.

4. Types of Instruments for ILO Assessment

ILOs are to be assessed using both direct and indirect measurements via a specific rubric for each ILO. This dual approach is a hallmark of robust assessment systems, providing a balanced perspective on student learning. FBSU adopts this strategy, employing a variety of instruments within these two broad categories.

4.1 Direct Measures

Direct measures involve the direct examination or observation of student knowledge and skills against stated learning outcomes. They provide concrete evidence of what students can

actually do and might include: ***Exams and Quizzes, Projects and Assignments, Presentations, Capstone Experiences, Portfolios, Performance Assessments,*** *and* ***Standardized Rubrics:***

4.2 Indirect Measures

Indirect measures gather perceptions or opinions about student learning and program quality. While they do not directly measure learning, they provide valuable insights into the student experience, satisfaction, and the perceived relevance of the education provided and might include*:* ***Course Exit Surveys, Program Exit Surveys (PES), Alumni Surveys, Employer Surveys/Feedback, Student Focus Groups, Faculty Surveys, and Institutional Surveys***

By employing a balanced mix of direct and indirect assessment instruments, FBSU can gather rich, multifaceted data to inform its understanding of student learning and drive continuous improvement efforts effectively.

5. The Role of General Education and Program Outcomes in ILO Assessment

Institution Learning Outcomes (ILOs) are achieved through a combination of learning experiences across a student's entire academic journey. This includes both specialized courses within their chosen program and the broader general education curriculum. A comprehensive ILO assessment framework, as modeled by FBSU, recognizes the distinct but complementary roles of program-specific learning outcomes (PLOs) and general education learning outcomes (often embedded as Course Learning Outcomes - CLOs within general education courses). General education outcomes into the ILO assessment framework, FBSU can ensure that all students, regardless of their major, are developing the core competencies defined by the institution.

At FBSU, all academic programs systematically align their Program Learning Outcomes (PLOs) with the Institutional Learning Outcomes (ILOs) through a structured mapping process. This alignment enables comprehensive assessment of student achievement at both program and institutional levels. These data are shared with the DQAA in order to assess the student achievement of the ILOs across the University

6. Aligning PLOs with Broader Institutional Goals

Academic programs are responsible for developing in-depth knowledge and advanced skills within specific disciplines. Program Learning Outcomes (PLOs) define what students in a particular program are expected to achieve. It is essential that these PLOs are not only discipline-specific but also aligned with and contribute to the overarching ILOs of FBSU.

For FBSU, this alignment process would involve:

1) **Comprehensive PLO-ILO Mapping:** Each academic program at FBSU (e.g., in Engineering, Computing) should conduct a thorough mapping of its PLOs to the university's ILOs. This exercise helps identify how each program contributes to the development of institutional graduate attributes and can also reveal any gaps where ILOs might not be adequately addressed within a program.
2) **Curriculum Design:** The curriculum of each program should be intentionally designed to ensure that students have sufficient opportunities to achieve both the PLOs and the mapped ILOs. This might involve specific courses, learning activities, projects, or capstone experiences that explicitly target these outcomes.
3) **Program-Level Assessment:** Each academic program should have its own systematic process for assessing its PLOs. The data from these program-level assessments, particularly for those PLOs that are strongly mapped to ILOs, serve as crucial evidence for ILO achievement at the institutional level.
4) **Reporting Contribution to ILOs:** Program assessment reports should not only focus on PLO achievement but also explicitly discuss how the program contributes to the broader institutional ILOs, referencing the mapping and providing relevant assessment data.

This alignment ensures that the specialized education provided within each program is also reinforcing and contributing to the holistic development of students as envisioned by the university's ILOs. It creates a cohesive educational experience where both general and specialized learning contribute synergistically to producing well-rounded, competent graduates.

7. The Assessment Cycle and Continuous Improvement

A cornerstone of an effective learning outcomes assessment system is its cyclical nature, designed to foster continuous improvement. A full assessment cycle will take 2-4 years to complete in order to close the loop of student achievement (or learning) of the institutional learning outcomes. FBSU structured cycle to ensure that its ILO assessment process is dynamic, responsive, and leads to tangible enhancements in teaching and learning.

Establishing a Multi-Year Assessment Cycle

Instead of attempting to assess all ILOs every year, which can be overwhelming and resource-intensive, a multi-year cycle allows the institution to focus on a subset of ILOs each year. For FBSU, a 2 to 4-year cycle could be practical:

- **Year 1:** Focus on assessing ILOs 1 & 2 (e.g., Knowledge & Understanding, Critical Thinking).
- **Year 2:** Focus on assessing ILOs 3 & 4 (e.g., Leadership, Communication & Teamwork).

- **Year 3:** Focus on assessing ILOs 5 & 6 (e.g., Digital Literacy, Social Responsibility & Ethics).
- **Year 4:** Review the findings from the entire cycle, make institution-wide adjustments, and begin the next cycle, possibly with revised ILOs or assessment methods based on the previous cycle's learnings.

This phased approach allows for more in-depth assessment of the selected ILOs each year and makes the process more manageable. The specific ILOs and the length of the cycle should be determined by FBSU based on its priorities and resources. The institution prepares a report every 4 years on the achievement of learning outcomes, which aligns with such a cyclical approach.

8. Templates and Reporting Framework for FBSU

The PSU document ("Section VI.pdf") provides several templates that are instrumental in operationalizing and documenting the ILO assessment process. These templates ensure consistency, clarity, and a systematic approach to collecting and reporting assessment data. While FBSU-specific public templates were not found on its website, FBSU could benefit significantly from developing or adapting similar templates to support its own ILO assessment framework. This section discusses the types of templates found in the PSU model and their potential utility for FBSU.

8.1 ILO Assessment Plan Template

Template for Planning Assessment of an ILO" and a "2-4 years Assessment Plan of ILOs Template" (Table 11: Template for Planning Assessment at the program level). Such a template is crucial for outlining how and when ILOs will be assessed.

ILO Assessment Plan Template could include fields such as:

- **Institutional Learning Outcome (ILO) Statement:** The specific ILO being addressed in this part of the plan.
- **NQF Learning Domain(s) Mapped:** (e.g., Knowledge, Skills, and Values).
- Operational Definition/Key Performance Indicators (KPIs) for the ILO: How will achievement of this ILO be recognized or measured?
- **Assessment Cycle Year:** (e.g., Year 1 of 4-Year Cycle).
- **Programs/Courses Involved in Assessment:** List of specific programs or general education courses that will provide data for this ILO.
- **Direct Assessment Methods & Instruments:** (e.g., Specific exam questions, project rubrics, capstone evaluations – with details of the instrument).
- **Indirect Assessment Methods & Instruments:** (e.g., Specific survey questions from PES, Alumni Survey, and Course Exit Survey mapped to this ILO).

- Target Benchmark/Expected Level of Achievement: For both direct and indirect measures.
- **Data Collection Timeline:** When will data be collected?
- **Responsible Person/Unit:** Who is responsible for overseeing the assessment of this ILO and collecting data?
- **Data Analysis Plan:** How will the collected data be analyzed?
- **Reporting Mechanism:** How and to whom will the findings be reported?

Having a standardized template for the assessment plan ensures that all necessary components are considered for each ILO being assessed and facilitates a consistent approach across the institution.

Table 11: Template for Planning Assessment at the program level

Points that need to be included in the assessment plan. The assessment plan needs to be submitted to the TLC prior to the assessment cycle for feedback.
Program Learning Outcome : (if any modifications to the PLOs explain the data used to modify the PLOs and provide justification for doing so)
Program Objective (optional)
Institutional Learning Outcome Mapping:
CLO to PLO mapping
Student Core competency
The Domain of Learning
List the courses which are assessed
Mapping to Program mission statement
Direct methods used for Assessment (Cover all three Domains)
Indirect methods used for Assessment (Cover all three Domains)

Note: Separate tables would be used to report benchmarks for direct & indirect methods of assessment.

8.2 ILO to PLO/Course Mapping Template

Effective ILO assessment relies on understanding how program-level and course-level learning contributes to institutional goals. The FBSU document includes templates for "ILO to PLO Mapping" (Table 12: Mapping of Institutional Learning Outcomes (ILOs) with Program Outcomes (SLOs) –equivalent to PLOs).

FBSU mapping templates typically take the form of a matrix Table 12:

ILO-PLO Mapping Matrix:

- Rows: List all Program Learning Outcomes (PLOs) for a specific academic program.
- Columns: List all FBSU Institution Learning Outcomes (ILOs).
- Cells: Indicate the level of alignment or contribution of each PLO to each ILO (e.g., using symbols like I (or w %) - Introduced, R (or w %) - Reinforced, M (or w %) - Mastered; or High, Medium, Low contribution). This matrix visually demonstrates how the program curriculum as a whole addresses the institutional outcomes.

These mapping documents are essential for curriculum review, ensuring that there are adequate opportunities for students to develop the ILOs, and for identifying which courses and programs are key contributors to specific ILOs, thereby informing the assessment plan.

Table 12: Mapping of ILOs with Program Outcomes (PLOs/SLOs/PIs)

NQF Domain	Learning Outcome (PLO/SLO/PI)	Institutional Learning Outcomes										
		Knowledge and Understanding				Skills				Values		
		K1	K2	K3	---	S1	S2	S3	---	V1	V2	----
Knowledge and Understanding	PLO #											
	PLO #											
	PLO #											
	.....											
Skills	PLO #											
	PLO #											
	PLO #											
	.....											
Values	PLO #											
	PLO #											
	.....											

8.3 Annual ILO Assessment Report Structure

FBSU need to prepare an annual ILO assessment report at the institutional level by the DQAA assessment committee. ILO Assessment Report include the following sections:

Part I: Overview of Assessment Activities for the Year/Cycle

1. ILOs that were the focus of assessment during this period.
2. Brief description of the assessment methods and instruments used.
3. Summary of data collection activities.

Part II: Assessment Findings for Each ILO Assessed

1. ILO Statement:
2. Performance Indicators/Target Benchmarks:

3. Summary of Direct Assessment Findings: (e.g., aggregated rubric scores, exam performance data, with comparison to benchmarks).
4. Summary of Indirect Assessment Findings: (e.g., key results from relevant survey questions, with comparison to benchmarks).
5. Analysis and Interpretation of Findings: What do the results mean? Were benchmarks met? What are the strengths and weaknesses in student achievement of this ILO?

Part III: Conclusions and Recommendations

1. Overall conclusions regarding student achievement of the assessed ILOs.
2. Specific, actionable recommendations for improvement
3. Identification of who is responsible for implementing the recommendations.
4. Timeline for implementation and follow-up.

Part IV: Use of Previous Assessment Results (Closing the Loop)

1. Brief report on actions taken based on recommendations from the previous assessment cycle for these ILOs.
2. Impact of those actions, if measurable yet.

8.4 Observations and Recommendations for FBSU

Fahad Bin Sultan University's (FBSU) publicly available resources, including its official website (fbsu.edu.sa), and proposes evidence-based recommendations to enhance its Institution Learning Outcomes (ILOs) framework. Aligned with international best practices in higher education quality assurance and benchmarked against other models, these recommendations aim to:

- Leverage ILO Assessment Data: Utilize the final ILO assessment report to identify institutional strengths, gaps, and alignment with FBSU's mission and Vision 2030 goals.
- Drive Continuous Improvement: Translate findings into targeted interventions (e.g., curriculum revisions, faculty development, or resource allocation) to elevate student learning and institutional effectiveness.
- Strengthen Accountability: Formalize a cyclical process where ILO review outcomes directly inform strategic planning, accreditation compliance, and stakeholder reporting.

9. Conclusion

The journey of defining, assessing, and refining ILOs is a continuous one, central to the mission of any higher education institution committed to excellence and accountability. Key takeaways from this modeled approach include the importance of clearly articulated ILOs aligned with institutional mission and national standards; a systematic and cyclical assessment process (such as the PIMRU model) involving both direct and indirect measures; robust mechanisms for data analysis and reporting; and, most critically, a commitment to

using assessment findings to drive meaningful improvements in curriculum, pedagogy, and student learning experiences.

While this report provides a conceptual blueprint, the successful implementation of such a framework at FBSU will depend on strong institutional leadership, broad faculty engagement, adequate resource allocation, and a sustained commitment to fostering a culture of evidence-based decision-making and continuous quality enhancement. The absence of detailed, publicly accessible FBSU-specific ILO documentation means that this report serves as a guide to *potential* structures and processes rather than an evaluation of existing ones.

It is hoped that the modeled discussions on ILO domains, assessment planning, implementation strategies, the role of general education and program-specific outcomes, and the establishment of a continuous improvement cycle will prove valuable to FBSU's faculty members, academic leaders, and reviewers. By embracing a transparent, systematic, and improvement-oriented approach to Institution Learning Outcomes, Fahad Bin Sultan University can further solidify its position as a leading private university in the Kingdom of Saudi Arabia, dedicated to preparing graduates who are knowledgeable, skilled, ethically responsible, and ready to contribute meaningfully to society.

Further steps for FBSU would involve internal deliberations to adapt or develop these modeled concepts into a concrete, operational framework that is fully owned and implemented by the university community. This endeavor, while significant, holds the promise of profoundly enhancing the quality and impact of an FBSU education.