Kuwait University

College of Engineering and Petroleum

Department of Petroleum Engineering

Petroleum Engineering Program Assessment Plan

Revised March 2024

Petroleum Engineering Program Mission, Vision and Objectives

Mission

The **mission** of the Department is to provide a modern petroleum engineering education with proper balance between theory and practice and to graduate petroleum engineers prepared for life-long learning and capable of being productive contributors for the oil and gas industry.

Vision

The **vision** of the department is to be a world-class provider of education and research for the oil and gas industry, to play a leadership role in providing new technologies in order to increase the petroleum reserves of Kuwait.

It is clear that the department mission is in harmony with the College and University missions (quality engineering education, advancement and dissemination of knowledge, service of the community to enhance its welfare, and use of modern technology). Furthermore, the department vision is also in harmony with the College and University visions (provision of world-class education, recognized regionally and internationally, that leads to successful graduates, prepared for professional creativity and leadership, able to contribute to the improvement of society).

The Petroleum Engineering Department mission and vision are published in the undergraduate bulleting as well as at the department website:

https://kuweb.ku.edu.kw/COEP/EngineeringPrograms/PEng/VisionandMission/index.htm

Program Educational Objectives (PEO)

The Petroleum Engineering (PE) Program Educational Objectives (PEO) have emerged from the working environment within the department. This environment is characterized by a spirit of dedication to the quality of education and by the cooperative spirit between the various constituents of the program. Furthermore, the Program Educational Objectives are established to satisfy the needs of Kuwait and they constitute the foundations upon which the student outcomes and curriculum of the Petroleum Engineering degree are built.

The Petroleum Engineering Department at Kuwait University aims at graduating Petroleum Engineers who will:

1. Engage in productive careers in petroleum engineering in public or private sectors, or successfully pursue graduate studies and careers in academia or research centers.

2. Advance in responsibility and leadership in their careers, and participate in continuous professional development to meet the challenges of rapidly emerging technology.

3. Contribute to the welfare of the society and the environment and the development of the profession through responsible practice of petroleum engineering and participation in professional activities and organizations.

The Program Educational Objectives of the Petroleum Engineering department ensure that the graduates of the program will play an active role in the efficient and safe production of oil and gas, which constitute the backbone of Kuwait economy.

The Program Educational Objectives of the Petroleum Engineering department are published in the college undergraduate bulletin as well as at the department website:

https://kuweb.ku.edu.kw/COEP/EngineeringPrograms/PEng/ProgramEducationalObjectivesandStudentOutcomes/index.htm

Revision and Assessment of Program Educational Objectives

The usual review process of the Program Educational Objectives (PEO) is based on the analysis and evaluation of the Alumni Survey (every three years) and the Employer Survey (ever four years). It takes also into consideration the inputs from the External Advisory Board, the Undergraduate Students Advisory Council, the local chapters of professional societies, and the faculty members. The PEO review process is a part of the overall assessment and evaluation process in the program as shown in Fig. 1. The current PEO were prepared by using a similar process. The final draft was communicated to the faculty members and discussed and adopted by the Department Council. The Program Educational Objectives were reviewed by the Department Undergraduate Program Committee and the External Advisory Board meeting. In light of the discussions that took place in all the meetings, it was concluded that the current Program Educational Objectives are satisfactory and there is no need to change them at this stage.

Student Outcomes

Student Outcomes are statements that describe what students are expected to know and what they are able to do by the time of their graduation. Achievement of all Student Outcomes indicates that the graduates are ready to achieve the Program Educational objectives. Furthermore, the Student Outcomes are student-centered and together with the Program Educational Objectives address the needs of all the constituents. The Student Outcomes are essentially parallel to those listed under Criterion 3 outcomes (1) through (7) as listed in the *Criteria for Accrediting Engineering Programs* for implementation in the 2023-2024 accreditation cycle with a one-to-one mapping.

The Student Outcomes of the Petroleum Engineering department are listed below:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. 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. An ability to communicate effectively with a range of audiences.

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The student outcomes are posted in the Petroleum Engineering department website:

https://kuweb.ku.edu.kw/COEP/EngineeringPrograms/PEng/ProgramEducationalObjectivesandStudentOutcomes/index.htm

The relationship between student outcomes and program educational objectives is shown in Table 1.

The student outcomes are developed into a number of outcome attributes that are more detailed and measurable through various assessment methods. The relationship between these outcomes and the curriculum is illustrated in Table 2, which is based on specific practices to achieve the attributes, and for consistency is continuously revised after each assessment cycle. The H (high), M (medium), and L (low) designations presented in the table are assigned by the Teaching Area Groups (TAG). They illustrate the importance and level of contribution of the various courses in addressing the student outcomes. The H, M, L notations are explained as follows:

- **H:** Indicates that demonstrating the specified knowledge or skill in the course is critical for the overall aggregate performance of the student, i.e., it is one of the most important student outcomes of the course. In teaching practice, it means: 1) formal instruction, 2) opportunities to develop and demonstrate the skill, and 3) formal assessment.

- **M:** Indicates that demonstrating the specified knowledge or skill in the course has a considerable impact on the overall aggregate performance of the student. In teaching practice, it means: 1) informal instruction, 2) opportunities to develop and demonstrate the skill, and 3) formal assessment.

- **L:** Indicates that demonstrating the specified knowledge or skill in the course has only minor impact on the overall aggregate performance of the student. In teaching practice, it means: 1) opportunities to demonstrate the skill, and 2) informal assessment.

In setting forth the assessment protocols, we always kept in mind the dynamic inter-relationship between the student outcomes and the program educational objectives. Therefore, the assessment procedures were designed to obtain simultaneous input on both objectives and outcomes.

Each student outcome is assessed and evaluated with the following items:

- **Outcome Indicators:** Specific measurable statements identifying the performance required to achieve the outcome.
- **Implementation Strategy:** Program activities, curricular and co-curricular, that will help address the outcome.
- **Evaluation Methods:** Assessment methods that will be used to collect data.
- **Logistics:** When and how often measurements are taken, and who collects, interprets and reports results.
- **Performance Metrics**: The level of performance that assures achievement of the outcome.

Figure 1 below shows the assessment and evaluation process in PE program. The part of the assessment plan showing how each student outcome is embedded in the curriculum is presented with the assessment and evaluation matrices for the petroleum engineering students are shown in the following section for each student outcome.

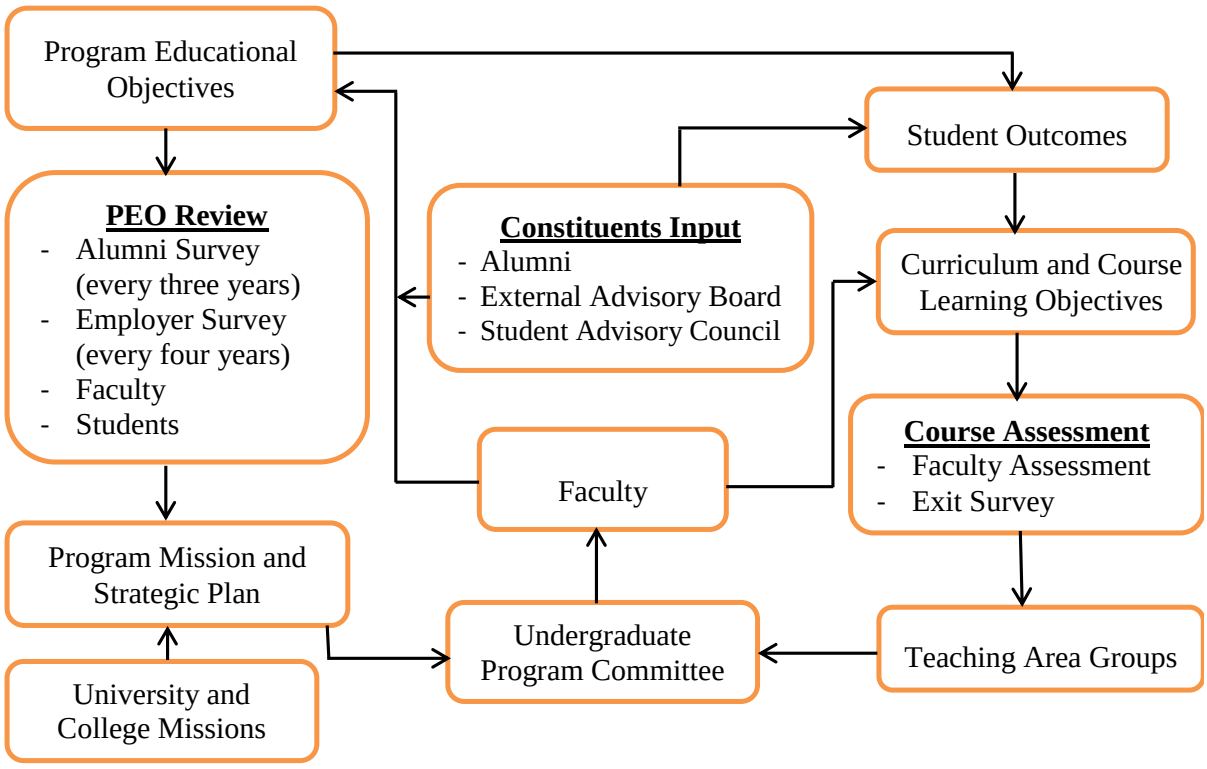

Figure 1. Assessment and Evaluation Process in PE Program

Table 1. Relationship between Program Educational Objectives and Student Outcomes

No.	Student Outcomes	Program Educational Objectives		
		1	2	3
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	✓	✓	
2	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	An ability to communicate effectively with a range of audiences.	✓	✓	
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal context.		✓	✓
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	✓	✓	✓
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	✓	✓	
7	An ability to acquire and apply new knowledge as needed using appropriate learning strategies.	✓	✓	✓

Table 2. Relationship between Student Outcomes and Various Curriculum Courses

Course No.	Course Title	Student Outcomes						
	General Education Requirements	***1***	***2***	***3***	***4***	***5***	***6***	***7***
HIST 100	Modern and Contemporary History of Kuwait (3 Credits)			L	H			L
HIST 102	History of Arab and Islamic Civilization (3 Credits)			L	H			L
	Humanities and Social Sciences Electives (6 Credits)				H			H
	English Language Courses (6 Credits)			H				
	Math, Science Courses and Labs (27 Credits)	H					M	
	Basic Engineering Requirements	***1***	***2***	***3***	***4***	***5***	***6***	***7***
ENGR 102	Engineering Workshop	L			H		M	
ENGR 104	Engineering Graphics and Design	L	L	H				
ENGR 202	Statics	M		M				
ENGR 204	Strength of Materials	H	M					L
ENGR 205	Electrical Engineering Fundamentals	H						H
ENGR 207	Electrical Engineering Fundamentals Lab	M		M		M	H	M
ENGR 208	Engineering Thermodynamics	H			L			
ENGR 209	Engineering Economy	H			M			
ENGR 304	Engineering Probability and Statistics	H			L		M	M
ENGR 307	Applied Numerical Methods & Programming in Engr.	H				M		L
	Petroleum Engineering and Geology Requirements	***1***	***2***	***3***	***4***	***5***	***6***	***7***
GEOL 101	Physical Geology (3 Credits)			M	M	L		M
PE 150	Introduction to Petroleum Engineering	L			L			
PE 221	Reservoir Rock Properties	M			L			L
PE 241	Fluid Mechanics	M					L	L
PE 251	Introduction to Petroleum Engineering Design		H	H		H	L	L
PE 322	Reservoir Rock Lab	L		H	M	M	H	
PE 323	Phase Behavior of Reservoir Fluids	H		L	M			H
PE 324	Reservoir Engineering	M			L		L	
PE 333	PVT Lab	L		H	M	M	H	
PE 341	Oil Well Drilling and Completion	M	M		L			L
PE 342	Mud and Cement Lab	L		M		M	H	
PE 351	Petroleum Geology	M	L		M			
PE 354	Well Logging	M			L		H	
PE 355	Well Logging Lab	M					H	
PE 411	Petroleum Production Engineering	H	H	M	M	M		L
PE 425	Natural Gas Reservoir Engineering	H	H		L		L	
PE 427	Secondary Recovery	H	H		L		L	
PE 432	Well Testing	H		L	M		H	M
PE 435	Artificial Lift and Production Equipment Design	H	H	H	M	H		M
PE 437	Numerical Methods in Petroleum Engineering	H	M	M	H	M		H
PE 449	Petroleum Economics				H		H	L
PE 496	Petroleum Engineering Design	H	H	H	H	H	H	L
	Two Petroleum Engineering Electives (6 Credits)							

Student Outcome 1

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

This outcome includes ability to demonstrate and apply knowledge of mathematics, science, and engineering to identify an engineering problem, formulates it mathematically, find and interpret a solution:

i. Knowledge of calculus, physics, and chemistry in depth.
ii. Mathematics with multivariate calculus, differential equations, and linear algebra.
iii. Probability and statistics.

This outcome is embedded in the curriculum through the following measurable outcome attributes:

Ability to:

1. Work with forces, moments, statics and dynamics of rigid bodies, electricity, materials chemistry, electrical circuits, basic fluid statics and dynamics, and basic thermodynamics (CHEM 101, CHEM 105, PHYS 101, PHYS 102, PHYS 105, PHYS 107, ENGR 202, ENGR 204, ENGR 205, ENGR 207, ENGR 208, PE 221, PE 241, PE 251, PE 322, PE 323, PE 324, PE 333, PE 341, PE 342, PE 411, PE 425, PE 435).

2. Use multivariate calculus, differential equations, and linear algebra in solving problem in thermodynamics, fluid mechanics, heat transfer, system modeling (MATH 111, MATH 211, MATH 240, ENGR 204, ENGR 304, ENGR 307, PE 241, PE 324, PE 341, PE 411, PE 425, PE 432, PE 435, PE 437, PE 496).

3. Use probability and statistics in experiments and measurements, use regression analysis and curve fitting to determine relationships between measured dependent and independent variables, use life and reliability concepts in the design of mechanical components (ENGR 304, ENGR 307, PE 251, PE 322, PE 333, PE 342, PE 351, PE 354, PE 355, PE 435, PE 449).

4. Apply the knowledge of mathematics and science in solving problems in engineering sciences (all engineering courses).

Assessment Methods and Evidence

1. Evaluation of Performance Indicators & Course Portfolios:

This student outcome is assessed through a variety of Performance Indicator methods, including exams, homework, quizzes, and projects. For each course, all student work will be evaluated, and samples of student work will be selected to demonstrate their proficiency in mathematics, science, and engineering problems, ensuring they exhibit the requisite outcome attributes. Established criteria for these Performance Indicators mandate a minimum score of 60% for students in each course. Performance level gradings are detailed in Table 3. This procedure is planned to be reviewed and enhanced every two years to promote ongoing enhancement.

Table 3: criterion for measuring these Performance Indicators

Performance Level	PI: % of students of students getting ⩾ 60%	Level of SO Achievement	Continues Improvement Action
5	>90%	Achieved	No action at this time.
4	80%-90%	Achieved with caution	Watch performance of this SO in other courses. If performance in majority of courses is at this level, then adopt measures described for Level 3.
3	70%-80%	Partially Achieved	Increase frequency of assessment and include multiple artifacts (e.g., assess student performance in exams, Quiz, and project or in multiple exams). Watch performance of this SO in other courses.
1 - 2	<70%	Not Achieved	Immediate action required. Examine teaching and assessment methodology, course pre-requisites and adopt measures as for Level 3.

2. Exit Surveys:

Graduating seniors are asked on their ability and confidence to apply general principles of mathematics, science, and engineering to engineering problems.

3. Faculty Survey:

Faculty should express satisfaction with students' ability to apply knowledge of mathematics, science, and engineering.

Table 4 illustrates the program assessment and evaluation matrix for student outcome 1.

Table 4. Program Assessment and Evaluation Matrix for Student Outcome 1

Outcome Indicators	Implementation Strategy	Evaluation Methods	Logistics
- Identify an engineering problem. - Formulate an engineering solution using either analytical and/or numerical solution. - Develop models describing the behavior of systems or processes. - Obtain solutions to predict behavior of systems or processes. - Evaluate and interpret model predictions.	- In science, general engineering and major core courses, i.e., Differential Equations (MATH 240), Thermodynamics (ENGR 208), Engineering Economy (ENGR 209), Probability and Statistics (ENGR 304), Numerical Methods in Eng. (ENGR 307), Fluid Mechanics (PE 241), Phase Behavior of Petroleum Fluids (PE 323) Reservoir Eng. (PE 324), Oil Well Drilling and Completion (PE 341), students analyze, formulate, and solve problems by identifying, isolating, and describing their important parameters. Students are also required to evaluate their results. - Students apply physics principles in modeling components of a system, use mathematical methods (analytical and numerical), and interpret model predictions in various core courses, i.e.PE 241, PE 341, PE 411, PE 427, PE 432, PE 435, PE 437, PE 496. - In the capstone design course (PE 496) students are required to work in teams to identify, formulate, and solve real-life petroleum engineering problems and to work on open-ended problems and projects	- Exams, quizzes, and homeworks. - Projects and lab reports. - Exit and alumni surveys.	- Course assessment every semester by instructors of relevant courses using Instructor Class Evaluation Form (ICEF). - TAG evaluations of course assessment. - Surveys: exit survey every year and alumni survey every 3 years. - Assessment coordinator analyzes and report results to UPC every one to two years.

Student Outcome 2

"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."

This outcome includes ability to design a system, component, or process to meet desired needs within realistic constraints pertaining to economical, environmental, social, ethical, safety, manufacturability, and sustainability.

This outcome is embedded in the curriculum through the following measurable outcome attributes:

Ability to:

1. Design a system, component, or a process that meets desired needs (PE 251, PE 341, PE 411, PE 435, PE 496).

2. Work in teams (PE 411, PE 435, PE 496).

3. Communicate the design process and results in the form of written reports and oral presentations (PE 411, PE 435, PE 496).

Assessment Methods and Evidence

1.Evaluation of Performance Indicators, Course Portfolios, and Computer Files	This student outcome is assessed by evaluating final technical reports and other documents related to design projects. In addition, electronic copies of students' computerized analysis are associated with their analysis. Established criteria for these Performance Indicators mandate a minimum score of 60% for students in each course. Performance level gradings are detailed in Table 3. This procedure is planned to be reviewed and enhanced every two years to promote ongoing enhancement.
2. Exit Surveys:	Graduating seniors will be asked about their ability to design a system, component, or process to meet desired needs.
3.Faculty Survey:	Faculty should express satisfaction with students' ability design a system, component, or process to meet desired needs within realistic constraints.

Table 5 illustrates the program assessment and evaluation matrix for student outcome 2.

Table 5. Program Assessment and Evaluation Matrix for Student Outcome 2

Outcome Indicators	Implementation Strategy	Evaluation Methods	Logistics
- Establish objectives of a design project based on needs. - Formulate the design problem based on objectives and constraints. - Generate ideas and alternative solutions for a given problem. - Evaluate alternatives and be able to choose the best alternative.	- In the courses Introduction to Design (PE 251), Drilling Engineering (PE 341), Production Engineering (PE 411), Artificial Lift and Production Equipment Design (PE 435), students are required to design components of a system using analytical and computational techniques. - In the capstone design course (PE 496), students are required to design and analyze petroleum engineering systems or components and to work in teams with engineers from various disciplines to design and solve real-life petroleum engineering problems. Team work is also required in PE 411, PE 435, and PE 496.	- Exams, quizzes, and homeworks. - Design project reports. - Technical written reports and oral presentations. - Exit and alumni surveys.	- Course assessment every semester by instructors of relevant courses using Instructor Class Evaluation Form (ICEF). - TAG evaluations of course assessment. - Capstone project reports and Industrial Training reports. - Surveys: exit survey every year and alumni survey every 3 years. - Assessment coordinator reports results to UPC every one to two years.

Student Outcome 3

"An ability to communicate effectively with a range of audiences."

This outcome is embedded in the curriculum through the following measurable outcome attributes:

Ability to:

1. Effectively write engineering reports (PE 251, PE 322, PE 333, PE 342, PE 411, PE 435, PE 496).

2. Communicate orally in open presentations to a wide range of audience (PE 411, PE 432, PE 435, PE 437, PE 496).

3. Use effective graphical and visual aids (PE 251, PE 411, PE 432, PE 435, PE 496).

4. Prepare posters and give a brief explanation of the project and results (PE 496).

Assessment Methods and Evidence

1. **Evaluation of Performance Indicators and Course Portfolios.** This student outcome is assessed through evaluating collection of students' engineering reports, including lab reports, proposals, progress reports, and technical reports. The portfolio also should exhibit the student's ability to summarize technical material which includes abstracts, executive summaries, and literature review. Established criteria for these Performance Indicators mandate a minimum score of 60% for students in each course. Performance level gradings are detailed in Table 3. This procedure is planned to be reviewed and enhanced every two years to promote ongoing enhancement.

2. **Faculty Survey:** Faculty should express satisfaction with students' ability to communicate effectively.

Table 6 illustrates the program assessment and evaluation matrix for student outcome 3.

Table 6. Program Assessment and Evaluation Matrix for Student Outcome 3

Outcome Indicators	Implementation Strategy	Evaluation Methods	Logistics
- Communicate effectively in written form. - Communicate effectively in oral form. - Communicate effectively in graphical form. - Communicate effectively in poster presentation.	- In the English courses (ENGL 123) and (ENGL 221) students take oral communication and technical writing. The students get the opportunity to improve these skills further throughout the curriculum. - In various PE labs (PE 322, PE 333, PE 342, PE 355), students are required to present their work in technical reports using MS Word and Excel. - In various compulsory courses especially senior courses such as Production Engineering (PE 411), Natural Gas Reservoir Engineering (PE 425), Secondary Recovery (PE 427), Artificial Lift and Production Equipment Design (PE 435), and the capstone design course (PE 496), students are required to deliver public presentations of their design projects. - In the capstone design course (PE 496) students are required to prepare posters and give a brief explanation of the project and results.in addition, students are required to give public presentations of their projects using visual aids techniques.	- Essays. - Projects and lab reports. - Presentations. - Exit and alumni surveys.	- Course assessment every semester by instructors of relevant courses using Instructor Class Evaluation Form (ICEF). - TAG evaluations of course assessment. - Surveys: exit survey every year and alumni survey every 3 years. - Assessment coordinator analyzes and report results to UPC every one to two years.

Student Outcome 4

"An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal context."

This outcome is embedded in the curriculum through the following measurable outcome attributes:

Ability to:

1. Awareness of important contemporary issues such as new technologies, energy supply and demand, etc... These issues are addressed in the general education and elective courses and in seminars given by invited speakers.

2. The impact of failure of components on the safety of individuals and on the economy of companies and the Country (PE 341, PE 411, PE 435, PE449, PE 496).

3. The importance of respecting the natural resources and protecting the environment (PE 324, PE 425, PE 427, PE 496, and elective courses).

4. The importance of respecting the traditions, culture, inheritance, and patrimony of the Country (PE 150, PE 411, PE 435, PE 496, and elective courses).

5. The importance of preserving the life of the natural resources as long as possible (PE 150, PE 324, PE 411, PE 425, PE 427, PE 449, PE 496, and elective courses).

Assessment Methods and Evidence

1. **Evaluation of Performance Indicators and Course Portfolios.** This student outcome is assessed through evaluating Final Technical reports of design projects in which students demonstrate their understanding of professional and ethical responsibility within the context of the project. They should show that ethical issues, including safety and environmental concerns play an important role in the project as suggested by:
   - Identify the ethical issues pertinent to the project.
   - Generate ethical criteria related to the project.
   - Incorporate these criteria in the justification of the final outcome of the project.

   Established criteria for these Performance Indicators mandate a minimum score of 60% for students in each course. Performance level gradings are detailed in Table 3. This procedure is planned to be reviewed and enhanced every two years to promote ongoing enhancement.
2. **Faculty Survey:** Faculty should express satisfaction with students' understanding of professional and ethical responsibility.

Table 7 illustrates the program assessment and evaluation matrix for student outcome 4.

Table 7. Program Assessment and Evaluation Matrix for Student Outcome 4

Outcome Indicators	Implementation Strategy	Evaluation Methods	Logistics
- Demonstrate knowledge of professional codes of ethics. - Evaluate ethical dimensions of a problem/case. Identify possible impact of engineering solutions on society and environment. - Recognize the responsibilities towards society and the environment. - Recognize the importance of preserving natural resources. - Recognize the importance of exploiting natural resources and at the same time maintaining clean environment.	- In Introduction to PE (PE 150) and Introduction to Design (PE 251) students are introduced to the codes of ethics. - In various PE Labs students are required to abide by the codes of ethics in the lab work (PE 322, PE 333, PE 342, PE 355). - In the capstone design course (PE 496) students are required to identify ethical issues and comply to ethical codes in deriving the solutions of their design projects. - In Engineering Economy (ENGR 209) and Petroleum Economics (PE 449), students are exposed to impact of economy on engineering solutions and vice versa. - In various compulsory and elective courses such as Drilling Engineering (PE 341), Production Engineering (PE 411), Natural Gas Reservoir Engineering (PE 425), Secondary Recovery (PE 427), Artificial Lift and Production Equipment Design (PE 435), and Petroleum Economics (PE 449), students are required to reflect the implication of this outcome.	- Exams, quizzes, and homeworks. - Essays. - Projects reports. - Exit and alumni surveys.	- Course assessment every semester by instructors of relevant courses using Instructor Class Evaluation Form (ICEF). - TAG evaluations of course assessment. - Surveys: exit survey every year and alumni survey every 3 years. - Assessment coordinator analyzes and report results to UPC every one to two years.

Student Outcome 5

"An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives."

This outcome is embedded in the curriculum through the following measurable outcome attributes:

Ability to:

1. Work in a team environment and experience brainstorming, constructive conflicts, and making compromises (PE 251, PE 322, PE 333, PE 342, PE 411, PE 435, PE 496).

2. Think independently, accept diversity, and respect others' opinion (PE 251, PE 322, PE 333, PE 342, PE 411, PE 427, PE 435, PE 496).

3. Assume a task responsibility within the team as a member or team leader.

4. Schedule project tasks (PE 251, PE 322, PE 333, PE 342, PE 411, PE 435, PE 496).

5. Understand the necessity and importance of project management and time frame restriction (PE 251, PE 322, PE 333, PE 342, PE 411, PE 435, PE 496).

6. Keep notebook to compile all the facts and activities related to the project (PE 251, PE 322, PE 333, PE 342, PE 411, PE 435, PE 496).

Assessment Methods and Evidence

1. Evaluation of Performance Indicators and Peer Evaluations:	A collection of students' assessment of their team members and their teamwork experience, to be turned in at the end of their projects. Established criteria for these Performance Indicators mandate a minimum score of 60% for students in each course. Performance level gradings are detailed in Table 3. This procedure is planned to be reviewed and enhanced every two years to promote ongoing enhancement.
2. Exit Surveys:	Graduating seniors will be asked about their teamwork experiences in their courses; whether those experiences were positive or negative; what they have learned from their experiences about the skills and strategy they could employ to make group work successful; what they know about the conceptual understanding of group dynamics, and their impression of the instruction and guidance of teamwork they receive from their professor.
3. Faculty Survey:	Faculty should express satisfaction with students' ability to function on multidisciplinary teams.

Table 8 illustrates the program assessment and evaluation matrix for student outcome 5.

Table 8. Program Assessment and Evaluation Matrix for Student Outcome 5

Outcome Indicators	Implementation Strategy	Evaluation Methods	Logistics
- Recognize essential requirements of effective team work. - Function effectively in teams to complete a given task. - Recognize the need and be able to work effectively with multi-national team members.	- In all PE Labs: Reservoir Rock Properties (PE 322), PVT (PE 333), Mud and Cement (PE 342), and Well Logging (PE 355), students conduct experiments and report results in teams. - In various PE core courses, i.e., Introduction to Design (PE 251), Production Engineering (PE 411), Secondary Recovery (PE 427), Artificial Lift and Production Equipment Design (PE 435), students conduct projects in teams. - In the capstone design course (PE 496) students are required to design and analyze petroleum engineering systems or components in teams and to work in teams with multi-national engineers to design and solve real-life petroleum engineering problems.	- Exams, quizzes, and homeworks. - Technical lab and project reports. - Written report and oral presentation. - Peer evaluation. - Exit and alumni surveys.	- Course assessment every semester by instructors of relevant courses using Instructor Class Evaluation Form (ICEF). - TAG evaluations of course assessment. - Surveys: exit survey every year and alumni survey every 3 years. - Assessment coordinator analyzes and report results to UPC every one to two years.

Student Outcome 6

"An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions."

This outcome is embedded in the curriculum through the following measurable outcome attributes:

Ability to:

1. Conduct experiments methodically, analyze data, and interpret results.

2. Use regression analysis to determine relationships between measures dependent and independent variables.

3. Design and realize experiments setups to measure physical properties and characteristics, or to test physical laws (PE 251, PE 322, PE 333, PE 342, PE 355).

Assessment Methods and Evidence

1. Evaluation of Performance Indicators and Course Portfolios:	A collection of students' assessment of laboratory notebooks and reports in which students demonstrate their ability to conduct experiments, analyze and interpret data. Established criteria for these Performance Indicators mandate a minimum score of 60% for students in each course. Performance level gradings are detailed in Table 3. This procedure is planned to be reviewed and enhanced every two years to promote ongoing enhancement.
2. Exit Surveys:	Graduating seniors are asked if they feel adequately prepared to independently design and conduct experiments
3. Faculty Survey:	Faculty should express satisfaction with students' ability to design and conduct experiments, as well as to analyze and interpret data.

Table 9 illustrates the program assessment and evaluation matrix for student outcome 6.

Table 9. Program and Assessment Evaluation Matrix for Student Outcome 6

Outcome Indicators	Implementation Strategy	Evaluation Methods	Logistics
- Design experiments or experimental procedure. - Conduct experiments. - Analyze and interpret experimental data.	- Students design experiment and/or interpret experimental data in Introduction to Design (PE 251), Rock Lab (PE 322), PVT Lab (PE 333), Mud and Cement Lab (PE 342), and Well Logging Lab (PE 355), Well Testing (PE432), Petroleum Economics (PE449)	- Exams and quizzes. - Lab reports. - Exit and alumni surveys.	- Course assessment every semester by instructors of relevant courses using Instructor Class Evaluation Form (ICEF). - TAG evaluations of course assessment. - Surveys: exit survey every year and alumni survey every 3 years. - Assessment coordinator analyzes and report results to UPC every one to two years.

Student Outcome 7

"An ability to acquire and apply new knowledge as needed using appropriate learning strategies."

This outcome is embedded in the curriculum through the following measurable outcome attributes:

Ability to:

1. Awareness of the importance of continuing education to keep up with ever-changing emerging technology after graduation (PE 496).

2. Ability to use knowledge and information resources such as library and internet (PE241, PE 251, PE 323, PE 411, PE 432, PE435, PE437, PE 496).

3. Ability to self-learn subjects and topics not covered in the curriculum but needed for the job.

For example, in the course PE 496 (Petroleum Engineering Design), the students have to use the library, internet, and company files and reports to execute their project.

Assessment Methods and Evidence

1.Evaluation of Performance Indicators, Course Portfolios, and Computer Files	This student outcome is assessed by evaluating samples from homeworks and reports demonstrating student ability to use the information-seeking tools in engineering. Established criteria for these Performance Indicators mandate a minimum score of 60% for students in each course. Performance level gradings are detailed in Table 3. This procedure is planned to be reviewed and enhanced every two years to promote ongoing enhancement.
2. Exit Surveys:	Seniors are asked whether or not they have participated in life-long learning activities on campus. They are also asked their perception of the need for life-long learning and their plans.

Table 10 illustrates the program assessment and evaluation matrix for student outcome 7.

Table 10. Program Assessment and Evaluation Matrix for Student Outcome 7

Outcome Indicators	Implementation Strategy	Evaluation Methods	Logistics
- Recognize the need for life-long learning as an essential requirement. - Acquire knowledge and skills independently. - Reflect on own understanding and learning.	- In various compulsory and elective courses students must conduct library and internet search to conduct their projects and self-educate themselves to improve their performance. - In several PE courses such as Production Engineering (PE 411), Well Testing (PE 432), Artificial Lift and Production Equipment Design (PE 435), and Numerical Methods in PE (PE 437), students have to learn new computer tools and software packages on their own. - In the capstone design course (PE 496), students are required to work on major projects under minimum supervision. - Students are encouraged to join professional societies and to engage in their activities. - Students are encouraged to attend technical lectures and seminars.	- Exams, quizzes, and homeworks. - Essays. - Projects reports. - Exit and alumni surveys.	- Course assessment every semester by instructors of relevant courses using Instructor Class Evaluation Form (ICEF). - TAG evaluations of course assessment. - Industrial Training reports. - Surveys: exit survey every year and alumni survey every 3 years. - Assessment coordinator analyzes and report results to UPC every one to two years.