Mission

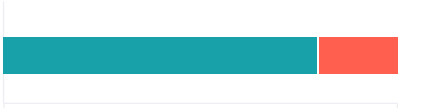
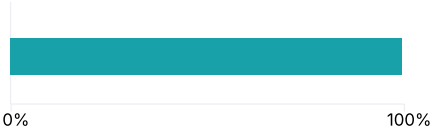
The Ph.D. degree is designed to prepare chemical engineers to advance research, development, and education for addressing national and global challenges towards a highly sustainable industrial-based focus on petroleum, petrochemical and allied industries.

Academic Year 2025-2026

PHD in Chemical Engineering - PHD-DPCM Learning Outcomes

Student Learning Outcome #1 MET

Students will demonstrate an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

MEASURES	RESULTS	ACTIONS
Dissertation: Performance Indicator (A) for Learning Outcome #1 (A) Identify complex engineering problems by applying proper engineering, science, and mathematical principles. • Excellent (4): Identify and fully describe complex engineering problems using correct specifications, design variables, and proper constraints. • Good (3): Identify and describe complex engineering problems but may have missing specifications, design variables, and proper constraints • Satisfactory (2): Partially identify and describe complex engineering problems missing some specifications/design variables/proper constraints • Unsatisfactory (1): Cannot Identify and describe complex engineering problems using specifications, design variables, and proper constraints Direct - Other **Target** 75% of students achieve the proficiency (A score of 3 or 4 out of 4)	MET Dissertation: Performance Indicator (A) for Learning Outcome #1 Met Not Met  0% 100% Met: 80% Not Met: 20% Met Total: 80% Not Met Total: 20% **Summary** Faculty evaluating the dissertation work were also asked to evaluate each student on the SLO based on the approved rubric. The results of the dissertation evaluations are below: Performance Indicator / Proficiency % / Non-Proficiency % / Average Score **Faculty Evaluations (Dissertation)** 1a 80.0% 20.0% 3.60 1b 80.0% 20.0% 3.20 1c 80.0% 20.0% 3.20 **Overall 80.0% 20.0% 3.33** The dissertation evaluation data include 5 assessment records. The numbers presented are summary statistics.	*No actions have been added.*
Qualifying Exam: Performance Indicator (B) for Learning Outcome #1 (B) Formulate the complex engineering problem by applying proper engineering, science, and mathematical principles. • Excellent (4): Formulate the complex problem mathematically by application of engineering and science theories and principles without mistakes.	MET Qualifying Exam: Performance Indicator (B) for Learning Outcome #1 Met  0% 100% *Values are not shown when too close to each other.* *Click or use arrow keys to see details.*	*No actions have been added.*

• Good (3): Formulate the problems mathematically by application of engineering and science theories and principles with minor mistakes. • Satisfactory (2): Model the problems mathematically by application of engineering and science theories and principles with mistakes and errors. • Unsatisfactory (1): Cannot formulate the problem mathematically by application of engineering and science theories and principles. Direct - Other **Target** 75% of students achieve the proficiency (A score of 3 or 4 out of 4)	Met: 100% Met Total: 100% Not Met Total: **Summary** Faculty evaluating the qualifying exam were asked to evaluate each student on the SLO based on the approved rubric. The results of the qualifying exam evaluations are below: **Faculty Evaluations (Qualifying Exam)** 1a: Proficiency 100.0%, Non-Proficiency 0.0%, Average Score 4.00 1b: Proficiency 100.0%, Non-Proficiency 0.0%, Average Score 3.67 1c: Proficiency 100.0%, Non-Proficiency 0.0%, Average Score 3.50 **Overall: Proficiency 100.0%, Non-Proficiency 0.0%, Average Score 3.72** The qualifying exam evaluation data include 6 assessment records. The numbers presented are summary statistics.	

Conclusion

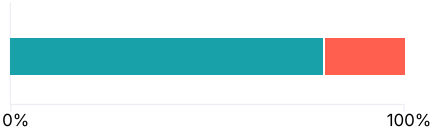
Analysis of Results - SLO #1
Per the above section, proficiency as indicated by the combined results is 90.9%. This exceeds the 75% benchmark and indicates an acceptable level of proficiency overall for students completing assessment activities in the PhD program in chemical engineering.
The qualifying exam evaluations achieved 100.0% proficiency with an average score of 3.72. The dissertation evaluations achieved 80.0% proficiency with an average score of 3.33. The combined result remains above the benchmark, but the dissertation-based results are lower than the qualifying exam results and should continue to be monitored.
Looking deeper into the performance indicators, the lowest dissertation-based average for this SLO was 1b, with an average score of 3.20. Although the overall SLO benchmark was met, this area should receive continued attention during dissertation advising and committee feedback.

Improvement Plan - SLO #1
Because the benchmark was met, major curriculum changes are not warranted based on this assessment cycle. However, the lower dissertation-based results indicate a need to continue supporting students as they move from qualifying exam work to independent dissertation research. To that end, the following improvement steps are proposed:

- Present the findings to department faculty to confirm that qualifying exam and dissertation expectations continue to promote the ability to identify, formulate, and solve complex engineering problems.
- Continue emphasizing problem definition, research motivation, mathematical or conceptual formulation, solution method, and interpretation of results throughout dissertation advising.
- Encourage dissertation committees to provide early and consistent feedback on problem formulation and research scope.
- Monitor future assessment cycles to determine whether the difference between qualifying exam and dissertation results persists.

Student Learning Outcome #2 MET

Students will demonstrate an ability to develop and conduct appropriate experimentation or numerical simulation, analyze and interpret data, and use engineering judgment to draw conclusions and produce solutions appropriately.

MEASURES	RESULTS	ACTIONS
Dissertation: Performance Indicator (A) for Learning Outcome #2 (A) Identify the needs, approaches and steps for experimental study or numerical simulation • Excellent (4): The objectives of the experiment or numerical simulation are	MET Dissertation: Performance Indicator (A) for Learning Outcome #2 Met Not Met  	*No actions have been added.*

clearly specified. The approaches to conduct the experiment or simulation are the best choices and the procedures are concise.
- Good (3): The objectives of the experiment or numerical simulation are specified. The approaches to conduct the experiment or simulation are of the good choices with good procedures.
- Satisfactory (2): The objectives of the experiment or numerical simulation are outlined. The approaches to conduct the experiment or simulation are feasible and the procedures are reasonably described.
- Unsatisfactory (1): The objectives of the experiment or numerical simulation are not clearly identified. Key components are missing in the approaches and/or the procedures.

Direct - Other

Target

75% of students achieve the proficiency (A score of 3 or 4 out of 4)

Met: 80%
Not Met: 20%

Met Total: 80%
Not Met Total: 20%

Summary

Faculty evaluating the dissertation work were also asked to evaluate each student on the SLO based on the approved rubric. The results of the dissertation evaluations are below:

Performance Indicator	Proficiency %	Non-Proficiency %	Average Score
Faculty Evaluations (Dissertation)			
2a	80.0%	20.0%	3.60
2b	80.0%	20.0%	3.00
2c	80.0%	20.0%	3.40
Overall	**80.0%**	**20.0%**	**3.33**

The dissertation evaluation data include 5 assessment records. The numbers presented are summary statistics.

Qualifying Exam: Performance Indicator (B) for Learning Outcome #2

(B) Obtain data from experimental test or numerical simulation following the steps or numerical simulation

- Excellent (4): Follow the procedure step by step when the experiment or simulation are carried out, and the data are clean and reproducible.
- Good (3): The step-by-step procedure is followed, and the data are good enough to be reproduced
- Satisfactory (2): Carry out the experiment or simulation without missing the critical steps and the data are useful and somewhat reproducible.
- Unsatisfactory (1): Have one or more major deficiencies in the experimental procedure or numerical simulation method and the data are not obtained or questionable.

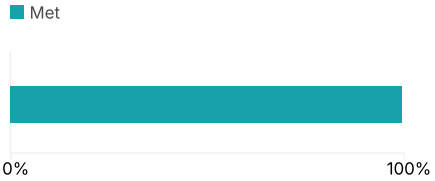
Direct - Other

Target

75% of students achieve the proficiency (A score of 3 or 4 out of 4)

MET

Qualifying Exam: Performance Indicator (B) for Learning Outcome #2



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Met: 100%

Met Total: 100%
Not Met Total:

Summary

Faculty evaluating the qualifying exam were asked to evaluate each student on the SLO based on the approved rubric. The results of the qualifying exam evaluations are below:

Performance Indicator	Proficiency %	Non-Proficiency %	Average Score
Faculty Evaluations (Qualifying Exam)			
2a	100.0%	0.0%	4.00
2b	100.0%	0.0%	3.83
2c	100.0%	0.0%	3.67
Overall	**100.0%**	**0.0%**	**3.83**

The qualifying exam evaluation data include 6 assessment records. The numbers presented are summary statistics.

No actions have been added.

Conclusion

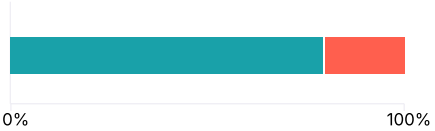
Analysis of Results - SLO #2
Per the above section, proficiency as indicated by the combined results is 90.9%. This exceeds the 75% benchmark and indicates an acceptable level of proficiency overall for students completing assessment activities in the PhD program in chemical engineering.
The qualifying exam evaluations achieved 100.0% proficiency with an average score of 3.83. The dissertation evaluations achieved 80.0% proficiency with an average score of 3.33. The combined result remains above the benchmark, but the dissertation-based results are lower than the qualifying exam results and should continue to be monitored.
Looking deeper into the performance indicators, the lowest dissertation-based average for this SLO was 2b, with an average score of 3.00. Although the overall SLO benchmark was met, this area should receive continued attention during dissertation advising and committee feedback.

Improvement Plan - SLO #2
Because the benchmark was met, no major curriculum change is required based on the present results. However, the program should continue to strengthen expectations for experimentation or numerical simulation, data analysis, and engineering judgment in doctoral research. To that end, the following improvement steps are proposed:

- Present the findings to department faculty to confirm that dissertation research continues to require appropriate experimentation or numerical simulation and rigorous data interpretation.
- Encourage dissertation committees to review experimental or simulation plans early in the research process and provide feedback on reproducibility, data quality, and analysis methods.
- Continue emphasizing clear presentation of data using tables, figures, regression, modeling, and appropriate engineering judgment.
- Monitor dissertation-stage performance in future cycles because it was lower than qualifying exam performance for this SLO.

Student Learning Outcome #3 MET

Students will demonstrate an ability to use modern engineering tools to produce engineering analysis in a systematic manner.

MEASURES	RESULTS	ACTIONS
Dissertation: Performance Indicator (A) for Learning Outcome #3 (A) Ability to use modern engineering tools • Excellent (4): Clearly demonstrated ability to use modern engineering tools • Good (3): Demonstrated acceptable ability to use modern engineering tools • Satisfactory (2): Demonstrated minimal ability to use modern engineering tools • Unsatisfactory (1): Does not demonstrate ability to use modern engineering tools Direct - Other **Target** 75% of students achieve the proficiency (A score of 3 or 4 out of 4)	MET Dissertation: Performance Indicator (A) for Learning Outcome #3 Met Not Met  0% 100% Met: 80% Not Met: 20% Met Total: 80% Not Met Total: 20% **Summary** Faculty evaluating the dissertation work were also asked to evaluate each student on the SLO based on the approved rubric. The results of the dissertation evaluations are below: Performance Indicator / Proficiency % / Non-Proficiency % / Average Score **Faculty Evaluations (Dissertation)** 3a 80.0% 20.0% 3.20 3b 80.0% 20.0% 3.60 **Overall 80.0% 20.0% 3.40** The dissertation evaluation data include 5 assessment records. The numbers presented are summary statistics.	*No actions have been added.*

Qualifying Exam: Performance Indicator (B) for Learning Outcome #3

(B) Quality of analysis

- Excellent (4): Clearly demonstrates ability to show results of engineering analysis in a high-quality fashion
- Good (3): Demonstrates acceptable ability to show results of engineering analysis in generally good quality
- Satisfactory (2): Demonstrates minimal ability to show results of engineering analysis, quality compromised
- Unsatisfactory (1): Does not demonstrate ability to show results of engineering analysis in an acceptable quality

Direct - Other

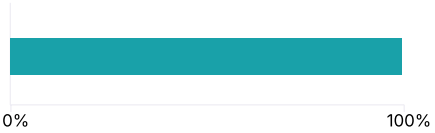
Target

75% of students achieve the proficiency (A score of 3 or 4 out of 4)

MET

Qualifying Exam: Performance Indicator (B) for Learning Outcome #3

Met



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Met: 100%

Met Total: 100%
Not Met Total:

Summary

Faculty evaluating the qualifying exam were asked to evaluate each student on the SLO based on the approved rubric. The results of the qualifying exam evaluations are below:

Performance Indicator	Proficiency %	Non-Proficiency %	Average Score
Faculty Evaluations (Qualifying Exam)			
3a	100.0%	0.0%	3.83
3b	100.0%	0.0%	3.67
Overall	**100.0%**	**0.0%**	**3.75**

The qualifying exam evaluation data include 6 assessment records. The numbers presented are summary statistics.

No actions have been added.

Conclusion

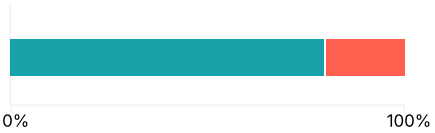
Analysis of Results - SLO #3
Per the above section, proficiency as indicated by the combined results is 90.9%. This exceeds the 75% benchmark and indicates an acceptable level of proficiency overall for students completing assessment activities in the PhD program in chemical engineering.
The qualifying exam evaluations achieved 100.0% proficiency with an average score of 3.75. The dissertation evaluations achieved 80.0% proficiency with an average score of 3.40. The combined result remains above the benchmark, but the dissertation-based results are lower than the qualifying exam results and should continue to be monitored.
Looking deeper into the performance indicators, the lowest dissertation-based average for this SLO was 3a, with an average score of 3.20. Although the overall SLO benchmark was met, this area should receive continued attention during dissertation advising and committee feedback.

Improvement Plan - SLO #3
Because the benchmark was met, no major curriculum change is required based on the present results. However, the program should continue to maintain intentional emphasis on modern engineering tools and systematic engineering analysis in doctoral research. To that end, the following improvement steps are proposed:

- Present the findings to department faculty to confirm that qualifying exam and dissertation work continue to require appropriate use of modern engineering tools.
- Continue supporting student access to modern software, instrumentation, computational tools, and analysis methods needed for doctoral research.
- Encourage dissertation committees to assess both the selection of tools and the quality of the systematic analysis produced using those tools.
- Monitor future assessment cycles to ensure that tool use remains connected to clear, high-quality engineering analysis.

Student Learning Outcome #4 MET

Students will demonstrate an ability to complete a doctoral dissertation and effectively communicate the dissertation work with a range of audiences.

MEASURES	RESULTS	ACTIONS
Dissertation Report: Performance Indicator (A) for Learning Outcome #4 (A) Dissertation significance • Excellent (4): Clear definition of thesis topic and the dissertation results can be published in peer-reviewed platforms • Good (3): Clear definition of thesis topic and the dissertation results can be organized in a presentable form to the committee but not a peer-review level • Satisfactory (2): Somewhat unclear definition of dissertation topic but with justified contributions • Unsatisfactory (1): No definition of dissertation topic Direct - Other **Target** 75% of students achieve the proficiency (A score of 3 or 4 out of 4)	MET Dissertation Report: Performance Indicator (A) for Learning Outcome #4 Met Not Met  Met: 80% Not Met: 20% Met Total: 80% Not Met Total: 20% **Summary** Faculty evaluating the dissertation and final dissertation defense were asked to evaluate each student on the SLO based on the approved rubric. The results of the faculty evaluations are below: Performance Indicator / Proficiency % / Non-Proficiency % / Average Score **Faculty Evaluations (Dissertation and Final Dissertation Defense)** 4a: 100.0% / 0.0% / 4.00 4b: 80.0% / 20.0% / 3.60 4c: 80.0% / 20.0% / 3.20 4d: 80.0% / 20.0% / 3.40 **Overall: 80.0% / 20.0% / 3.55** The dissertation and defense evaluation data include 5 assessment records. The numbers presented are summary statistics.	*No actions have been added.*

Dissertation Defense: Performance Indicator (B) for Learning Outcome #4

(B) Organization of dissertation

- Excellent (4): The organizational scheme is logical and complete and makes the report especially pleasurable to read.
- Good (3): Organizational scheme shows planning and logical order with small deficiencies.
- Satisfactory (2): Organizational scheme is not apparent and detracts from readability.
- Unsatisfactory (1): Dissertation is not organized and difficult to read.

Direct - Other

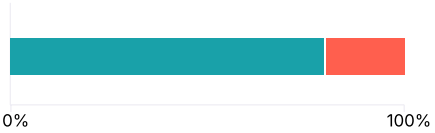
Target

75% of students achieve the proficiency (A score of 3 or 4 out of 4)

MET

Dissertation Defense: Performance Indicator (B) for Learning Outcome #4

Met Not Met



Met:	80%
Not Met:	20%
Met Total:	80%
Not Met Total:	20%

Summary

Faculty evaluating the dissertation and final dissertation defense were asked to evaluate each student on the SLO based on the approved rubric. The results of the faculty evaluations are below:

Performance Indicator	Proficiency %	Non-Proficiency %	Average Score
Faculty Evaluations (Dissertation and Final Dissertation Defense)			
4a	100.0%	0.0%	4.00
4b	80.0%	20.0%	3.60
4c	80.0%	20.0%	3.20
4d	80.0%	20.0%	3.40
Overall	**80.0%**	**20.0%**	**3.55**

The dissertation and defense evaluation data include 5 assessment records. The numbers presented are summary statistics.

No actions have been added.

Conclusion

Analysis of Results - SLO #4
Per the above section, proficiency as indicated by the combined results is 80.0%. This exceeds the 75% benchmark and indicates an acceptable level of proficiency overall for students completing assessment activities in the PhD program in chemical engineering.
The dissertation and final dissertation defense evaluations achieved 80.0% proficiency with an average score of 3.55. The result exceeds the 75% benchmark, but it is the lowest overall proficiency among the PhD SLOs in this assessment cycle.
The lowest average score was for 4c, with an average score of 3.20. This indicates that continued emphasis on dissertation organization, defense presentation, and impromptu question-and-answer skills is appropriate.

Improvement Plan - SLO #4
Because the benchmark was met but the proficiency rate was lower than the other PhD SLOs, the program should continue to focus on dissertation quality and research communication. To that end, the following improvement steps are proposed:

- Present the findings to department faculty to confirm that dissertation committees apply consistent expectations for dissertation significance, organization, presentation quality, and question-and-answer performance.
- Encourage advisors to provide structured feedback on dissertation organization, publication readiness, and defense presentation before the final defense.
- Continue emphasizing that students should clearly communicate the significance, methods, results, limitations, and broader contribution of their dissertation work.
- Monitor SLO #4 closely in future assessment cycles because it had the lowest proficiency percentage in the present PhD assessment cycle.