Academic Assessment Report

PhD / Industrial Engineering

June 1, 2022

Program Goals

1. Prepare students for independent research in Industrial Engineering.
2. Prepare students to contribute new knowledge of fundamental importance.
3. Contribute new knowledge of fundamental importance or significantly modify, amplify, or interpret existing knowledge in a new and important manner.

Student Learning Outcomes (SLO)

1. Students will make satisfactory progress toward the degree, preparing for independent research to contribute new knowledge of fundamental importance to Industrial Engineering.
2. Students will be prepared for independent research in Industrial Engineering.
3. Students will be prepared to contribute new knowledge of fundamental importance to Industrial Engineering.
4. Students will contribute new knowledge of fundamental importance to Industrial Engineering or significantly modify, amplify or interpret existing knowledge in a new and important manner
5. Students will be able to communicate effectively.

Assessment Process

1. Timeline
   a) Annual Graduate Student Academic Reviews submitted to the Graduate School by June 30
   b) For those students who joined the program before fall 2018: Candidacy Exam after approximately two years of graduate study; for those who joined the program in fall 2018and beyond: (with a master's degree) must attempt the qualifying exam before the beginning of their third long semester or (without a master's degree) [direct admits] must attempt the exam before the beginning of their fifth long semester.
   c) Dissertation Proposal may not occur in the same semester as Candidacy Exam
   d) Final Oral Defense may not occur in the same semester as Dissertation Proposal
   e) Assessment results and analysis presented at August faculty "retreat" to stimulate discussion about any program (or assessment process) changes.
2. Means of assessment
   a) SLO1 assessed annually (indirect and direct)
      - Cumulative GPA (desired level of achievement >= 3.0)
      - Annual Graduate Student Academic Review by graduate coordinator in consultation with student advisor (desired level of achievement is "satisfactory")

b) SLO2 assessed with Candidacy Exam
   - Student self-assessment of independent research preparation with respect to **Comprehension** (understanding literature), **Application** (problem solving), **Analysis and Synthesis** (support for generalizations, alternative solutions), and **Evaluation** (validity)
   - Advisory Committee members assessment of independent research...

c) SLO3 assessed with Dissertation Proposal
   - Student self-assessment of preparation to contribute new knowledge with respect to...
   - Dissertation Committee members assessment of preparation to contribute new knowledge...

d) SLO4 assessed with Final Oral Defense
   - Student self-assessment of contributing new knowledge...
   - Dissertation Committee assessment of contributing new knowledge...

e) SLO5 assessed with Candidacy Exam, Dissertation Proposal, and Final Oral Defense
   - Student self-assessment of effective communication
   - Committee members assessment of effective communication

3. Reported annually to the Dean: Assessment results and analysis, and any consequential program or assessment process changes

Assessment Results

1. Annual Graduate Student Academic Reviews

Table 1. Academic Warning letters received from the Graduate School after following semesters

	2020	**2021**	**2022**
fall	0	0	0
spring	0	0	1

2. Candidacy Exam, Dissertation Proposal and Final Oral Defense

Scores in Table 2 are averages of medians across Student, Chair and Member responses after the Candidacy Exam, Dissertation Proposal and Final Oral Defense.

Table 2. The student is prepared for independent research or to contribute new knowledge, or has contributed new knowledge based on…

	2020	**2021**	**2022**
Comprehension	4.62	5.00	4.73
Application	4.59	5.00	4.71
Analysis	4.59	5.00	4.54
Evaluation	4.62	4.67	4.44

3. Effective Communication

Scores in Table 3 are averages of medians across Student, Chair and Member responses after the Candidacy Exam, Dissertation Proposal and Final Oral Defense.

Table 3. The student has demonstrated effective communication skills

2020	2021	2022
4.60	4.67	4.52

Consequential Program Changes

2020

Faculty will discuss consequential program changes at August "retreat."

- Table 2. INEG PhD students maintained their performance on Comprehension (understanding literature), Application (problem solving), Analysis (support for generalizations, alternative solutions) and Evaluation (validity) in the past 3 years. Analysis and Evaluation are relative strengths.
- Table 3. The communication skills of INEG PhD students continued to improve.

The first course-based PhD qualifying exam was administered in Summer 2019 and retake tests were given over three consecutive days starting the Monday one week before the first day of Spring 2020.

Review of First Qualifier Exam Results

As part of a continuous improvement process, the graduate studies committee was charged by the department head to review the qualifier exam and assess whether any changes were warranted. A summary of the committee's review of the first qualifier instance is provided.

Six INEG PhD students completed their first attempt of the qualifying exam in August 2019, for a total of eighteen individual tests taken (three per student). Nine of the eighteen tests were passed and nine were failed. Two of the six students passed all three tests, thereby passing the qualifying exam. After the first attempt, the faculty teams that prepared the individual tests were asked to prepare written feedback to the students so that the students were aware of their inadequate understanding in each subject. Four of the six students proceeded with a retake attempt in January 2020, for a total of nine individual tests taken (2 students took 3 tests [in Choice A and Choice C, respectively]; 1 student took 2 tests [in Choice C]; and 1 student took 1 test [in Choice B]). Seven of the tests were passed and two were failed (INEG 5613 Introduction to Optimization Theory; INEG 5323 Engineering Applications of Stochastic Processes). Two of the four students who attempted a retake passed the qualifying exam, and two failed. The students again received written performance feedback after the second attempt.

During the review process, we tried to discuss the underlying causes for the two failures. Both

of the students who failed did so on the basis of a single "minor area" test in their qualifying exam choice (the committee adopted the language "minor area" in their discussions to refer to the two MS-level tests in each exam choice). Both students had no prior IE domain knowledge. Yet, both are DAF students and both appear to be doing well with respect to research. This caused a lot of discussion (again over things that had been discussed for over 2 years) in the graduate committee about the purpose of the exam.

Some of the positives noted by the committee are that the exam makes some perceived strides towards increasing the level of rigor in the doctoral program. At least one committee member perceived that their doctoral advisee became a better student as a result of preparing for the qualifying exam. The committee chair had an informal discussion with some of the students who failed the first attempt, and the students agreed that they had significantly improved their understanding of the key concepts after preparing for the retake.

Some of the concerns noted by the committee are that one-third of our doctoral students admitted in 2019 failed out of the PhD program as a result of the qualifying exam. There is some concern over whether this is sustainable, for example, with respect to its impact on faculty research programs. Another concern is the current process does not take a comprehensive view of the three individual test scores, instead relying on binary, independent decisions on each test, in which a failure on any single test results in a failure on the entire exam.

After discussion with the entire faculty, the following changes were proposed but will not be executed for the second INEG PhD qualifying exam to be administered in the summer of 2020.

Added: PhD Qualifying Exam Objective

The objective of the INEG PhD Qualifying Exam is to assess both general and specialized knowledge in the student's area of study.

Table 1: Schedule of Tests

Day 1 Monday	Day 2 Tuesday	Day 3 Wednesday
Engineering Statistics	**Systems Simulation I***	Introduction to Optimization Theory
	Advanced Stochastic Processes	Engineering Applications of Stochastic Processes
	Linear Optimization	

***will be replaced with Systems Simulation II beginning August 2021**

2021

Faculty will discuss statistics in Tables 1 – 3 at August "retreat."

- Table 1. We received no Academic Warning Letters since the last assessment report.
- Table 2. The scores in all four areas (i.e., Comprehension (understanding literature), Evaluation (validity), Application (problem solving), Analysis (support for generalizations, alternative solutions)) have improved in the last year. This is perhaps partially due to receiving more reviews from students and faculty members and due to the fact that we are reporting average of median scores.
- Table 3. Scores associated with Effective Communication have also improved.

2022

Faculty will discuss consequential program changes at August "retreat."

- Table 2. INEG PhD students maintained their performance on Comprehension (understanding literature), Application (problem solving), Analysis (support for generalizations, alternative solutions) and Evaluation (validity) in the past 3 years.
- Table 3. The communication skills of INEG PhD students continue to be good.

Assessment Process Changes

2020

Faculty will discuss consequential assessment process changes at August "retreat." Although an updated assessment form was uploaded to the departmental web site and students, Chair and Members have been reminded to complete the form, the problem with missing answers to those questions was not completed resolved. A mandatory action could be initiated to resolve the problem.

2021

Faculty will discuss assessment process changes during the faculty retreat in August. As noted in the 2019 and 2020 summaries above, students and faculty were reminded to complete the assessment reports which resulted in an increase in the number of reports submitted.

2022

Faculty will discuss consequential assessment process changes during the August retreat. Students and faculty are reminded to complete the assessment reports each semester.