Institutional Effectiveness Report
2021-2022

Program: Engineering PhD

College and Department: College of Engineering

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Mission: The PhD program is a research degree and aims to enhance research quality and external recognition. The program goal has evolved to provide increasing prospects for the students to focus on research in five specialization areas as well as opportunities to pursue interdisciplinary research involving one or more of these specializations.

Description of Program

The College of Engineering (CoE) at Tennessee Tech University (TTU) first began offering a Doctor of Philosophy in Engineering (PhD-Engr) degree in 1971. The PhD-Engr is a single, college-wide degree for all departments. However, students pursuing this degree will do so in an area of specialization, listed below, hosted by a CoE department. The college-wide program also allows students to develop an interdisciplinary research topic that cuts across one or more of these specializations.

PhD Specialization Area	Host Department
Chemical Engineering	Chemical Engineering Department (CHE)
Civil Engineering	Civil and Environmental Engr. Dept. (CEE)
Computer Science	Computer Science (CSC)
Electrical & Computer Engr.	Electrical & Computer Engineering (ECE)
Mechanical Engineering	Mechanical Engineering Department (ME)

Purpose of the PhD Program

The purpose of the PhD Program is to provide students with an opportunity for advanced studies and research in the field of engineering and computer science. As a research-based degree, the focus is on developing the independent learning skills of students in preparation for advanced-level, research-focused employment in industry or academia.

Program Goals:

PG 1: Increase the average enrollment to 90, based on a 3-yr rolling average.

PG 2: Increase the average number of students completing the PhD program to 20 per year by 2020-21.

PG 3: In anticipation of the PhD program review taking place in 2020, continuous improvements have been planned and components implemented. Major changes to the program, including redefinition of student assessments and streamlining the process. These plans also include assessment tools, data analysis, and improvement actions.

Student Learning Outcomes:

SLO 1:   The student should demonstrate breadth of knowledge in the discipline and depth in the specific area of his/her research topic.

SLO 2:   The student should gain experience in doing independent academic work and research.

SLO 3:   The student should demonstrate his/her ability to identify and define the research topic.

SLO 4:   The student's research work should contribute to the existing knowledge in the engineering field.

SLO 5:   The student should demonstrate the ability to clearly communicate complex engineering and research topics in both verbal and written format.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

Assessment Methods:

PG 1:   *Increase the average enrollment to 90, based on a 3-yr rolling average.*

1.   *3-yr Avg PhD Enrollment:* Three-year rolling average of number of students enrolled in the PhD program is a better indicator of trends than year-to-year data, which may be subject to fluctuations

PG 2:   *Increase the average number of students completing the PhD program to 20 per year by 2020-21.*

1.   *3-yr Avg PhD Degrees Conferred:* Three-year rolling average of number of students graduating per year is a better indicator of trends than year-to-year data, which may be subject to fluctuations

SLOs 1-5:

1.   *Program of Study*: Every PhD student must complete a Program of Study (PoS) prior to completing 15 credit-hours of course work. The PoS is developed under the guidance of the student's Advisory Committee (AC). The courses specified in the PoS ensures the depth of knowledge needed for the research topic (SLO 1). The student will develop a research topic with the help of her/his major advisor and the AC. In developing the research topic, students will also develop the depth and breadth of the knowledge needed in their field (SLO 1). The depth and knowledge and the ability to conduct independent academic research (SLO 2) through definition of an appropriate research topic for a dissertation (SLO 3) must be demonstrated through the comprehensive examination process.

2.   *Comprehensive Exam*: The comprehensive examination involves examination of the depth and breadth of the specific knowledge in the field of study, and a written proposal describing the research the student will conduct (SLO 3). Through the proposed research, students must establish their clear and unique contributions to their field of study (SLO 4)

and defend their ideas during the presentation of the proposal and oral examination (SLO 5). Completion of student's research is culminated in a written dissertation examined by the AC and defended publicly through an oral examination (SLO 1-5).

Results:

PG 1:   Increase the average enrollment to 90, based on a 3-yr rolling average.

Enrollment - PhD Program CoE

	2014F	2015F	2016F	2017F	2018F	2019F	2020F	2021F
# Students	66	88	85	105	106	101	104	124
3-yr Avg	55	67	80	93	99	104	104	111

PG 2:   Increase the average number of students completing the PhD program to 20 per year by 2020-21.

Degrees Conferred - PhD Program CoE

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
# Students	7	12	8	15	21	10	10
3-yr Avg	10	9	9	12	15	15	14

SLOs 1-5:

Comprehensive Exams

	2017-18	2018-19	2019-20	2020-21	2021-22
# Students	15	35	23	15	17
#Pass on first attempt	14	35	23	15	17

Modifications for Improvement:

SLO 5:   The student should demonstrate the ability to clearly communicate complex engineering and research topics in both verbal and written format.

The CoE is adding a new assessment of student learning in AY2023. Students completing the dissertation proposal or defense will be evaluated using the Oral Defense and Dissertation Assessment Form (see Appendix 2). The form evaluates both oral presentation skills related to Content, Visual Aids, Presenter Appearance, Presentation Mechanics, and Response to Questions and Comments, as well as, writing skills related to Quality of English, Technical Content, and Technical Writing.

All dissertation proposals and defenses must be held publicly when the PhD candidate will present her/his research to an audience of other students, faculty and staff and members of the public and in presence of their Advisory Committee. All present at this defense will be asked to complete the rubric to assess the quality of the presentation. There has been additional harmonization among the departments for consistency in the rubric used.

Appendices
1. Curriculum Map
2. Oral Defense and Dissertation Assessment Form

Appendix 1: Curriculum Map

Engineering PhD

Coursework	Student Learning Objectives				
	Demonstrate Depth and Breadth of Knowledge	Gain Experience in Independent Academic Work and Research	Identify and Define the Research Topic	Contribute to Existing Knowledge	Communicate Effectively
6XXX and 7XXX Coursework*	X		X		
7980 Directed Study	X	X			
7990 Research and Dissertation	X	X	X	X	X

College of Engineering PhD Program
Oral Defense and Dissertation Assessment Form

Candidate Name: _____ Engineering discipline: _____

Committee Member ___ Faculty _____ Student _____ (Please check one)

Date: _____

Evaluation of Oral Presentation

Oral Presentation Type (circle): Proposal Defense   Dissertation Defense

Graduates of the PhD program must be able to communicate their ideas effectively with their technical peers and with others outside their discipline. Please assess this candidate's oral presentation and written work using the following scale:

Not	Below	Meets	Above
Acceptable	Expectation	Expectation	Expectation
1	2	3	4

1 2 3 4   **Content:** appropriate, complete, concise, and logically organized; problem, approach and results clear; appropriate use of time.

1 2 3 4   **Visual aids:** readable and clear, concise wording, effective use of graphics, appropriate amount of information

1 2 3 4   **Presenter:** appears well-prepared, vocabulary technically correct and audience-appropriate

1 2 3 4   **Presentation mechanics:** volume of voice is good, good enunciation, appropriate speed in delivery; free of hesitations, distracting mannerisms; good poise, eye contact

1 2 3 4   **Responses to questions and comments**: appropriate, direct, and complete

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Evaluation of Dissertation Document

1 2 3 4   **Quality of English**: good grammatical form, voice, tense, punctuation. Concise presentation

1 2 3 4   **Technical content**: clear description of problem, state-of-the-art, technical approach, and results; relevant and timely references

1 2 3 4   **Technical writing**: good organization; clear description of problem; clear figures and tables