

Nanoscience and Nanoengineering Assessment Plan

Student Assessment:

Assessment of student progress is a continual process throughout the PhD, the foremost responsibility rests with the faculty advisor, PhD committee and *the students themselves*. By working together, the student, advisor and committee can inform research decisions, build and confirm relevant skills and competencies in the student, and ensure meaningful contributions to the students' area of specialization. Students learn to frame, plan, execute and analyze nanoscience and nanoengineering research by regular consultation, primarily with their advisor, and secondarily with other committee members or outside experts as determined by ongoing evaluation of research. Short term and long term goals are framed, and continually assessed and adjusted as the PhD research program evolves.

A program of study is designed to complement the student's proposed research area, in consultation with the faculty advisor, preferably in the first semester. Adjustments are made as needed within the first two to three years of the program. A written exam covering key concepts covered in the core curriculum is administered no later than the end of the students second year, to assess the demonstration of advanced knowledge covered in the core curriculum. On or before spring semester of the third year, students prepare a written research proposal and defend this to their PhD committee. At that time, the committee will assess the students' knowledge of the relevant literature, as demonstrated in the research proposal and during the proposal defense. The committee will assess the level of specialized knowledge based on the contents of the proposal, which should include preliminary work and likely publication(s) documenting this, or minimally concrete evidence that such publications are forthcoming. Any deviation from these schedules must be approved by the Nano PhD Program Advisory Committee (Nano AC), as outlined in the Nano PhD Program Handbook.

Student participation in professional meetings and campus research symposia will provide an assessment as to the level and quality of the students' research, and are encouraged. Participation in the Nano PhD program Nano Expo is required by all students in the program. This allows the students to develop oral and written communication skills, and is assessed by groups of at least two Faculty and one student judge. The PhD dissertation and defense will assess the level of the students' original contribution, as measured by products including the dissertation and mandatory peer-reviewed publications, per the program publication requirement. The publications, required oral presentations and proposal will also document the students' abilities and accomplishments in utilizing contemporary tools, methods and theory to evaluate the results of their research.

The Ph.D. proposal and proposal defense, and later the PhD dissertation and defense, are evaluated to ensure they address contemporary challenges in nanoscience and nanoengineering or a closely aligned field, and that the student demonstrates cognizance and understanding of the relevant scientific and technical literature. Further, these document that the student has demonstrated significant accomplishments in the relevant methods, tools, and theory pertaining to their chosen research topic, and have attained the appropriate level in written and oral communication to clearly convey their findings. The PhD advisor and committee are charged with assessing the impact of the student's work on the field, and ensuring the student exhibits high professional ethics.

External peer review of student research, based on conference participation (preferably peer-reviewed) and peer-reviewed journal publications are quantifiable metrics which assess student progress during the course of the PhD program, and can be tied to program outcomes. Table one shows the measures by which progress on the program outcomes can be assessed, and their corresponding metrics for success. In addition to the student and advisor paying careful attention to the steady progress towards meeting these metrics, the Nano PhD program administration also tracks these metrics. The Nano AC, which meets monthly, will assess each students progress on a semester basis in order to ensure timely completion of the degree.

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Program Outcomes, Measures and Metrics:

OUTCOMES	MEASURES	METRICS
(1) Students demonstrate advanced knowledge of the physics, chemistry and engineering at the nano-scale	Qualifying Exam.	70% overall minimum.
	Cumulative GPA.	Equal or exceed 3.0.
	Publications.	2 Peer-reviewed articles.
(2) Students demonstrate specific knowledge as pertaining to their area of specialization.	Dissertation.	Successfully defended.
	Presentations.	3 seminars minimum.
	Publications.	2 Peer-reviewed articles.
(3) Students will utilize contemporary methods, tools, and theory to perform research in their area of specialization.	Research credits.	Pass/Fail.
	Dissertation.	Successfully defended.
	Publications.	2 Peer-reviewed articles.
(4) Students are cognizant of the scientific literature in their area of specialization, and understand contemporary issues and frontiers.	Presentations.	3 seminars minimum.
	Research proposal.	Successfully defended.
	Dissertation.	Successfully defended.
	Publications.	2 Peer-reviewed articles.
(5) Students will develop a technically sound research plan to address a research problem.	Research proposal.	Successfully defended.
	Dissertation.	Successfully defended.
	Experimental plans.	Approved by advisor.
(6) Students will communicate effectively in written and oral presentations.	Presentations.	3 seminars minimum.
	Research proposal.	Successfully defended.
	Dissertation.	Successfully defended.
(7) Students demonstrate intellectual honesty when working with data and ideas.	Research proposal.	Successfully defended.
	Publications.	2 Peer-reviewed articles.
	Dissertation.	Successfully defended.
(8) Students have made an original contribution to nanoscience or nanoengineering.	Presentations.	3 seminars minimum.
	Publications.	2 Peer-reviewed articles.
	Dissertation.	Successfully defended.

Table 1: Program Outcomes, measures and metrics for assessment of student achievement.

Program and Curriculum Assessment:

The Nano AC will also review curriculum annually, in light of contemporary developments in the fields of nanoscience and nanoengineering, and ensure curriculum is updated accordingly. The following elements for continuous improvement are implemented:

- i. Each course syllabi, agenda, and lecture materials will be examined and discussed in committee.
- ii. Grade distributions and student surveys will be evaluated to identify any areas which may need improvement.
- iii. A self-assessment will be maintained by the Nano AC, in preparation for external reviews, to be completed on a time schedule set by University and SDBOR policy (currently seven years).
- iv. A three-year self-study will be completed by the Nano AC, in preparation for the external review on the seventh year.

The above elements, including both internal and external reviews, are a mechanism for continuous improvement, ensuring relevant curriculum and optimal training of Nanoscience and Nanoengineering PhD students.
