Mechanical Engineering PhD Program Timeline and Milestones

prepared by the Mechanical Engineering Graduate Curriculum Committee
approved by the ME Faculty, November 2018

Summary: This document presents expected timelines for PhD students in Mechanical Engineering (ME). ME Faculty adopted this timeline to provide milestones for PhD students to reach on a semester-by-semester basis for three different entry scenarios into the PhD program:

1) entering with BS in any engineering field or MS not in Mechanical Engineering,
2) entering with MS in Mechanical Engineering from another institution,
3) entering with MS in Mechanical Engineering from Mines.

Table 1 shows how the timeline is adjusted to accommodate PhD students entering with these three different backgrounds. The objectives for the timeline are three-fold:

- to provide clarity on critical deadlines and necessary steps to graduation,
- to encourage efficient progress by PhD students and Advisors toward graduation,
- to promote regular and constructive interactions between a student and their Dissertation Committee.

PhD students must make adequate progress and reach appropriate milestones toward their degree by working with their Faculty Advisor and Dissertation Committee. The steps to reach each milestone are listed here with more detailed explanation of each step given below:

- Select a permanent Advisor
- Complete the PhD qualifying examination
- Establish a Dissertation Committee
- Present a Research Proposal
- Submit Degree Audit and Admission to Candidacy forms
- Present a Preliminary Defense
- Present a Dissertation Defense

Additional milestones include journal publication and public presentation requirements.

Qualifying Exam:

Students enrolled in the ME PhD program are required to pass a Qualifying Exam. The PhD Qualifying Exam will be administered at a specific date during every semester by each research division independently. Each research division will appoint a Qualifying Exam chair, who oversees the process and ensures that the exam is administered fairly. Students must take the exam by no later than the end of their third semester in the PhD program. If the student fails the exam on their first attempt, they must retake the exam in the following semester with a maximum of two attempts to pass. One-semester extensions may be granted upon request to students who are enrolled as part-time or with non-ME backgrounds.

The Qualifying Exam assesses some attributes expected of a successful PhD student, including:

- ability to review, synthesize and apply fundamental concepts;
- creative and technical potential to solve open-ended, challenging problems;

- technical communication skills.

A written exam not to exceed 4.5 hours will be administered. The written exam will be divided into no more than five topical areas related to the research division, with topics announced in advance of the exam. Research Divisions will choose topical areas related to foundational undergraduate material and linked to material in the core graduate courses required by that Research Division. The students, in consultation with faculty Advisors, will choose three topical areas. Upon completion of the written exam, students will choose one paper from a list of papers established by overseeing faculty within the relevant Research Division. Students will be given two weeks to write a two-page critical review of the paper that also discusses possible extensions of the research.

Students, with a satisfactory performance on the written exam, will participate in an oral exam not to exceed 2.0 hours. The oral exam is conducted by the relevant Division's qualifying Exam Committee and the student's Advisor. The Division will specify the exam format in advance.

Exam results of Pass, Conditional Pass or Fail will be provided to the student in a timely manner by an Exam Coordinator. A Conditional Pass requires a student to pursue a remedial plan.

Research Proposal:

After passing the Qualifying Examination, the PhD student will prepare a written Research Proposal for the Dissertation and present it formally to the Dissertation Committee, which is selected by the student and the student's Advisor and approved by the Department Head. A written Research Proposal document consisting of no more than 10 pages will be provided to the Committee in advance of the presentation with the expectation of achieving the following:

- Demonstrate a thorough familiarity with the background and motivation of the research problem being undertaken as embodied by a review of the relevant literature;
- Enumerate specific aims and/or hypotheses;
- Identify preliminary techniques, materials, specific measurements, and parametric variations, for the proposed research project;
- Explain clearly the scientific merit ("value added") of the proposed work;
- Provide a general idea of the timeline for the research program;
- Specify potential publications and presentations that may arise from the work.

The student and the Advisor must convene a meeting of the full Dissertation Committee in which the student gives an oral summary of their written proposal in a 30-45 minute presentation. This Research Proposal gives the Committee a chance to discuss the work early and to help the student more clearly define the work and identify the salient aspects. For most students, Research Proposal presentation will happen early in year two.

Degree Audit and Admission to Candidacy:

A PhD Student must file for Admission to Candidacy after completing all required graduate coursework. Ph.D. students must complete the Degree Audit form by the posted deadlines and the Admission to Candidacy form by the first day of classes in the semester in which they want to be considered eligible for reduced registration.

Additionally, full-time Ph.D. students must complete the following requirements within the first two calendar years after enrolling in the Ph.D. program:

- have a Dissertation Committee appointment form on file in the Graduate Office;
- complete all prerequisite and core curriculum course requirements;
- demonstrate adequate preparation and satisfactory ability to conduct doctoral research;
- be admitted into full candidacy for the degree.

Reduced Registration:

A student becomes reduced registration eligible once they have
1) earned 72 credit hours (combined coursework and research),
2) paid for 54 credit hours (including transfer of credit if applicable), and
3) achieved candidacy.

Preliminary Defense:

Prior to the final Dissertation Defense, the PhD student will make an oral presentation to the student's Committee to summarize research accomplishments and remaining goals and work plan. This meeting serves as a final check to assess if the student's progress is on schedule for graduation. This meeting should present a preliminary document that will likely evolve and expand into the Dissertation. The preliminary document should include basic literature review, methodologies used, results to date, and an estimated timeline for remaining work. The student must give no more than a 45-minute presentation that focuses on the work already accomplished, including a summary of their relevant publication(s), followed by a proposed plan of the work needed to culminate in a formal defense and graduation. The Committee will provide feedback and, as necessary, revisions to the proposed work plan such that its completion should lead to a successful Dissertation Defense and publication record in a realistic time frame. The time period between the Research Proposal and the Preliminary Defense can span a few years, but the Preliminary Defense should take place preferably 12 months and no less than 6 months prior to the date of Dissertation Defense.

Required Number of Publications and Presentations:

The required and recommended journal publications for PhD students prior to graduation are listed below. Students wanting to defend before meeting these requirement must submit a one-page petition with reasonable explanation to the ME Graduate Curriculum Committee.

Journal publications – *Required:* Minimum of one first-author paper accepted or published (DOI is required) in a peer-reviewed journal (recognized as high quality in the research field), before Dissertation Defense. *Recommended:* Three or more first-author papers accepted or published in peer-reviewed journals. More than three first author journal publications are recommended for students interested in academic positions.

Presentations – *Required:* Minimum of one research presentation (poster or podium) at an external technical conference before the Dissertation Defense. Minimum of three presentations in the research division's MEGN 503 or equivalent (such as campus-wide graduate student research conference, research sponsor meetings, or additional conference presentations) during PhD program. *Recommended:* Two or more conference presentations (poster or podium), before the Dissertation Defense in which the student is the first author on

these presentations. Numerous conference presentations are strongly encouraged to establish a reputation amongst researchers in a field for students interested in academic positons.

Dissertation Defense:

At the conclusion of the student's Ph.D. program, the student will be required to make a formal presentation and Defense of their thesis research. A student must "pass" this defense to earn a Ph.D. degree. The Dissertation document should be submitted to the Dissertation Committee degree within 10 days prior to the Defense. The Committee will perform a post-presentation review of the Dissertation and technical contributions and publicactions with the student and the Committee may request revisions to the Dissertation and additional work that requires subsequent review by the Advisor and or the Committee.

Progress and Degree Time Limit:

To ensure that a student receives proper feedback if progress toward the Preliminary Defense or the Dissertation Defense is not satisfactory, the Advisor must provide the student and the Committee a brief, written progress evaluation. If the student's progress is unsatisfactory such that the Advisor gives them a PRU grade for research credits, the student will go on academic probation as outlined in the Graduate Bulletin.

As stipulated by the Mines Graduate School, PhD candidates must complete all requirements for the degree within nine years of the admission date into the degree program.

Table 1 – Expected PhD candidate timeline for three different entry scenarios

(*Termination of orange colored bars marked with a "D" indicates an expected completion date in that semester for the corresponding milestone. Exceptions to indicated deadlines must be made by petition to the ME Graduate Curriculum Committee. Blue colored bars indicate ranges for working toward completion of Preliminary and Dissertation Defense.*)

Student's Admission Status	Milestones	Year 1			Year 2			Year 3			Year 4			Year 5		
		FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU
1. Entering PhD with BS in any Engineering field or MS not in Mechanical Engineering *A minimum of 36 credit hrs of course work and 30 credit hours of research credits must be completed. A minimum of 12 of the 36 credit hrs of required coursework must be taken at Mines. The degree requires 72 credit hrs.*	**Coursework/Research credit hrs per semester/summer ⇨**	9/0	9/0	0/4	6/6	6/6	0/4	6/6	0/9	0/4	0/4	0/4	0/4	0/4	0/4	0/4
	a. Select Permanent Advisor			D												
	b. Complete Qualifying Exam (1st attempt within first 15 months in the program)				D											
	c. Establish Thesis Committee					D										
	d. Research Proposal Presented						D									
	e. Submit Degree Audit (student completed 36 credit hrs of coursework)								D							
	f. Submit Admission to Candidacy (requires completion of a-e)								D							
	g. Preliminary Defense															
	h. Dissertation Defense (cannot occur sooner than 6 months following the prelim. defense)															
2. Entering PhD with MS (outside of Mines) *Up to 36 credit hrs of course work can be transferred from an MS-Thesis degree. A minimum of 30 credit hrs of research credits must be completed. A minimum of 12 credit hrs of required coursework must be taken at Mines. The degree requires 72 credit hrs.*	**Coursework/Research credit hrs per semester/summer ⇨**	9/0	9/0	0/4	0/12	0/12	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4
	a. Select Permanent Advisor		D													
	b. Complete Qualifying Exam (1st attempt within first 9 months in the program)		D													
	c. Establish Thesis Committee				D											
	d. Research Proposal Presented					D										
	e. Submit Degree Audit (student completed 36 credit hrs of coursework with at least 12 credit hrs is at Mines)					D										
	f. Submit Admission to Candidacy (requires completion of a-e)					D										
	g. Preliminary Defense															
	h. Dissertation Defense (cannot occur sooner than 6 months following the prelim. defense)															
3. Entering PhD with MS (from Mines) transitioning from MS to PhD *Up to 36 credit hrs of course work can be transferred from an MS-Thesis degree. A minimum of 30 credit hrs of research credits must be completed. The degree requires 72 credit hrs.*	**Coursework/Research credit hrs per semester/summer ⇨**	6/6	6/6	0/4	0/12	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4
	a. Select Permanent Advisor	D														
	b. Complete Qualifying Exam (attempt the first QE offered after completing MS)	D														
	c. Establish Thesis Committee		D													
	d. Research Proposal Presented			D												
	e. Submit Degree Audit (student completed 36 credit hrs of coursework)				D											
	f. Submit Admission to Candidacy (requires completion of a-e)				D											
	g. Preliminary Defense															
	h. Dissertation Defense (cannot occur sooner than 6 months following the prelim. defense)															