

The MS with Thesis program is targeted toward students who are interested in pursuing both coursework and independent study. It is typically completed in 2 years.

Course Requirements

- 2 BME systems physiology courses (these courses can count towards the total 5 engineering course requirement below)
- 1 statistics course
- 1 quantitative sciences and engineering course
- 5 engineering courses total (one may be BME 499 research credit)
- Other courses
- Seminar courses (three quarters, zero credit – do not count towards the nine (9) units of courses, but required)

The departmental requirements for the degree of Master of Science (with thesis) are as follows:

1. **Course Requirements Completion of at least nine 300- or 400-level graduate courses for a letter grade** (i.e. P/N courses are not accepted), but no more than two units of BME 499 research credit; only 1 unit of 499 may be taken for credit in one term. These courses must include a core curriculum of
 - i. **BME Systems Physiology Courses** At least two of the following courses: BME 401, 402, 403. Previous credit can be established for these courses by filing a petition approved by the Chair of the Graduate Program Committee, but if so, they must be replaced with other courses approved by their adviser.
 - ii. **Statistics Course** Typical content includes: Probability distributions; testing for normality; t-tests; F-tests; non-parametric tests; power analysis and regression analysis. Note that students should review course syllabi to avoid repeating courses similar to those taken at another institution. Previous credit can be established by filing a petition approved by the Chair of the Graduate Program Committee, but if so, it must be replaced with an Engineering Course (see iv)
 - Choose from: STAT 330-1; IEMS 303.
 - iii. **Quantitative Sciences and Engineering Course** One course must be taken from the list of [Quantitative Sciences and Engineering Courses](#).
 - iv. **Engineering Courses** Of the 9 courses required for the degree, 5 must be engineering courses. One of the engineering courses may be BME 499 research credit.
 - v. **Other Courses** Students are allowed to take one course oriented towards business, global health, law, etc., with permission from the Graduate Program Chair.
For those students that do not have an adequate mathematics background (ordinary differential equations; multivariable and vector

- calculus; linear algebra), additional courses may be required at the discretion of the MS Program Chair.
- vi. **Seminar Courses** All students are required to complete three quarters of BMD_ENG 512.
 - vii. **Responsible Conduct of Research (RCR) training** All incoming BME graduate students are required to complete Responsible Conduct of Research (RCR) training. For Master's students, this consists of the online CITI training only.
 - viii. The above requirements may be satisfied, upon petition to the faculty, by substitution of other appropriate classes at Northwestern that provide competency similar to that provided by the required classes.

2. Plan of Study Students are required to submit a plan of study in [GSTS \(Graduate Student Tracking System\)](#), consistent with the above guidelines, prior to the beginning of the second quarter of enrollment. This plan must be approved by the academic advisor and then the Graduate Program Chair. Note that this is just an initial plan; appropriate changes can be made with approval of the advisor and the Graduate Program Chair. Failure to submit the plan on time or to follow the approved plan may lead to a delay in graduation.

3. Committee Requirements Students are required to complete and defend a Master's thesis to satisfy the requirement for a comprehensive exam. An examination committee for an MS thesis consists of at least three faculty members with one, including the chair, from the department, a minimum of two, including the chair, from The Graduate School faculty, and a minimum of two who are full-time members of the Northwestern faculty. All committees must be approved by the department 6 months prior to a defense. If a student selects a research advisor who does not have an appointment in the Biomedical Engineering Department, it is incumbent upon the student to select a faculty member within the department who will chair the examination committee. Further, the student should meet and confer regularly with the committee chair regarding coursework and research progress.

4. Thesis Requirements Students should aim to complete their research by the end of the 7th quarter. An acceptable dissertation resulting from research is one of the following: paper submitted to a peer reviewed journal article with student as primary author or a written document that conforms to the requirements set forth in the [Guidelines for Preparing the Dissertation](#). The format of this document is an extended journal article.

5. Typical Timeline

- 1st quarter - enroll in 3-4 courses and no research credits. Submit Plan of Study in GSTS. Begin looking for a thesis advisor.
- 2nd quarter - enroll in 3-4 courses, one or more may be research if the thesis advisor has been identified. By the end of the 5th week, students are to identify their research advisor and have their thesis committee approved in GSTS. Students should begin to develop their project plan shortly after identifying their research advisor. The project is to be roughly equal to that

of a full paper. If an advisor has not been identified, students should be prepared to complete the course-based MS.

- 3rd quarter - enroll in 3-4 courses. One or more of these courses may be research, BME 499 (graded). By the end of the 5th week, a thesis project plan should be submitted via GSTS and approved by the MS committee. Begin research.
- 4th quarter - begin full-time thesis research. Register for TGS 512.
- 5th quarter - continue full-time thesis research. Register for TGS 512. Complete committee meeting by the end of the 5th week and a timeline to completion must be submitted in GSTS and approved by the committee. The purpose of the committee meeting is to make sure that the student is making adequate progress toward the degree and can complete the scope of research in 1-2 additional quarters. At the committee meeting, the student will present an intro, 2-4 data slides, and future work with an expected timeline for completion.
- 6th quarter – continue full-time thesis research. Register for TGS 512.
- 7th quarter – write up thesis or paper. Register for TGS 512. Submit thesis according to [TGS deadlines](#).
 - Enrollment in TGS 512 costs only \$100/quarter. When enrolled in TGS 512, students are not eligible for the health insurance subsidy or the U-pass for Chicago's public transportation system.

6. Transfer into PhD Program Transferring from the MS Program into the PhD Program is for exceptional candidates only.

Students in the MS with thesis program can apply for a transfer after completing at least one year in the program and conducting significant research towards their thesis (at least 3 quarters of full time research). To apply for a transfer, students must have maintained a graduate GPA of at least the 3-year average of current BME PhD students and have held at least one thesis committee meeting to evaluate their research performance before February 15th of the year in which they are applying.

Applications to transfer can be submitted through the BME Office and must include the following materials.

- Unofficial Northwestern Transcript
- Three letters of recommendation including one from the faculty member who will serve as the student's advisor
- Plan of study for all remaining courses to be taken at Northwestern
- Brief statement of research plan (1 page maximum)

Applications will be accepted on **January 15th of each year**. Upon receipt, applications will be reviewed by the relevant graduate committees, which will be responsible for the final decision. Materials from the applicants' original MS application (undergraduate transcript, reference letters, test scores, etc...) will also be considered.

Thesis MS Requirements
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If accepted into the PhD program, all courses completed for the MS degree will be counted toward the PhD degree. Transferring students will be subject to the same qualification exams as those entering the PhD program directly. Transferring students will be expected to take the regularly scheduled PhD qualifying exam in the year in which they are admitted.