

# ENGINEERING SCIENCE AND MECHANICS

## Degree Requirements

### Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

At least 31 credits at the 400, 500, or 800 must be earned, with at least 18 at the 500 or 800 level, and at least 6 at the 500 level. Of these, 22 must be from lecture/laboratory courses approved by the department.

| Code                                                                                 | Title                                     | Credits   |
|--------------------------------------------------------------------------------------|-------------------------------------------|-----------|
| <b>Required Courses</b>                                                              |                                           |           |
| ESC 514                                                                              | Engineering Science and Mechanics Seminar | 1         |
| or EMCH 514                                                                          | Engineering Science and Mechanics Seminar |           |
| Select 3 credits in each of the following areas:                                     |                                           | 12        |
| Analysis                                                                             |                                           |           |
| Fields                                                                               |                                           |           |
| Motion                                                                               |                                           |           |
| Materials Performance/Reliability or Materials Processing/Structure/Characterization |                                           |           |
| Select 3 additional credits from any one of the four categories above                |                                           | 3         |
| <b>Electives</b>                                                                     |                                           |           |
| Select 12 elective credits                                                           |                                           | 12        |
| <b>Culminating Experience</b>                                                        |                                           |           |
| ESC 596                                                                              | Individual Studies                        | 3         |
| or EMCH 596                                                                          | Individual Studies                        |           |
| <b>Total Credits</b>                                                                 |                                           | <b>31</b> |

A scholarly written report on a developmental study involving at least one area represented in the course work must be written while enrolled in either ESC 596 or EMCH 596. This scholarly paper should reflect the high quality of research required to meet the Engineering Science and Mechanics M.Eng. degree standards, as determined by the ESM Graduate Officer and the ESM Graduate Curriculum Committee.

A 3.0 minimum grade point average is required to maintain good academic standing and for graduation.

### Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

#### Thesis Track

At least 32 credits at the 400, 500, 600, or 800 level must be earned, with at least 18 credits at the 500 and 600 levels combined, and 24 credits must be from 400- and 500-level lecture/laboratory courses approved by the department. No more than 6 credits may be earned from 400-level courses.

| Code                                                                                                                      | Title | Credits |
|---------------------------------------------------------------------------------------------------------------------------|-------|---------|
| <b>Required Courses</b>                                                                                                   |       |         |
| Select 3 credits in the area of Mathematical Methods in Engineering (EMCH 524A, or an equivalent or more advanced course) |       | 3       |

|                                                     |                                           |           |
|-----------------------------------------------------|-------------------------------------------|-----------|
| Select 3 credits in the area of Mechanics           |                                           | 3         |
| Select 3 credits in the area of Materials           |                                           | 3         |
| Select 3 credits in the area of Engineering Science |                                           | 3         |
| EMCH 514                                            | Engineering Science and Mechanics Seminar | 2         |
| or ESC 514                                          | Engineering Science and Mechanics Seminar |           |
| <b>Electives</b>                                    |                                           | <b>12</b> |
| <b>Culminating Experience</b>                       |                                           |           |
| Select 6 credits of thesis research:                |                                           | 6         |
| EMCH 600                                            | Thesis Research                           |           |
| EMCH 610                                            | Thesis Research Off Campus                |           |
| ESC 600                                             | Thesis Research                           |           |
| ESC 610                                             | Thesis Research Off Campus                |           |
| <b>Total Credits</b>                                |                                           | <b>32</b> |

A thesis is required and at least 6 credits of thesis research must be included in the student's program of study. The thesis must be a well-organized account of research undertaken by the student and must show initiative and originality. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

A 3.0 minimum grade-point average is required to maintain good academic standing and for graduation.

#### Non-Thesis Track

At least 32 credits at the 400, 500, 600, or 800 level must be earned, with at least 18 credits at the 500 level, and 27 credits must be from 400- and 500-level lecture/laboratory courses approved by the department. No more than 6 credits may be earned from 400-level courses.

| Code                          | Title                                                                          | Credits   |
|-------------------------------|--------------------------------------------------------------------------------|-----------|
| <b>Required Courses</b>       |                                                                                |           |
| EMCH 524A                     | Mathematical Methods in Engineering (or an equivalent or more advanced course) | 3         |
| EMCH 514                      | Engineering Science and Mechanics Seminar                                      | 2         |
| or ESC 514                    | Engineering Science and Mechanics Seminar                                      |           |
| <b>Electives</b>              |                                                                                | <b>24</b> |
| <b>Culminating Experience</b> |                                                                                |           |
| ESC 596                       | Individual Studies                                                             | 3         |
| or EMCH 596                   | Individual Studies                                                             |           |
| <b>Total Credits</b>          |                                                                                | <b>32</b> |

The student is required to complete an independent research experience resulting in a scholarly paper, for which 3 credits of ESC 596 or EMCH 596 will be earned. This scholarly paper should reflect the high quality of research required to meet the Engineering Science and Mechanics M.S. degree standards, as determined by the ESM Graduate Officer and the ESM Graduate Curriculum Committee.

A 3.0 minimum grade-point average is required to maintain good academic standing and for graduation.

### Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. ESMCH degree is conferred in recognition of high attainment and productive scholarship. Students may enter the Ph.D. program after

completing an M.S. degree or directly from the B.S. degree. Students entering with a M.S. degree take 18 graduate course credits, 3 credits of seminar, and a minimum of 6 and up to 12 research credits.

The minimum number of course credits required for students entering the Ph.D. program with a baccalaureate degree:

A student must earn at least 27 course credits in 400- and 500-level lecture/laboratory courses approved by the department, and 5 credits in a graduate seminar (EMCH 514/ESC 514). No more than 6 of the 27 course credits can be in 400-level courses. As part of the 27 course credits, at least 3 will be in an advanced mathematics course (EMCH 524A or equivalent). Furthermore, at least one course (of at least 3 credits each) must be taken from each the following three categories: Mechanics, Materials, and Engineering Science (a list of the courses in these categories is provided in the Graduate Programs Guide of the Engineering Science and Mechanics Department).

A minimum of 15 course credits must be in the major (courses with EMCH and/or ESC prefixes).

Twelve credits of letter grade Thesis Research with EMCH 600/ESC 600 designation are required. Students are allowed to register for EMCH 600/ESC 600 credits beyond the 12 required, but these credits will receive a grade of "R" if successfully completed. Students are allowed to register for EMCH 600/ESC 600 credits only before passing the Comprehensive Examination, after which they must register for EMCH 601/ESC 601 for 0 credits.

The student must demonstrate English competency, and pass a qualifying examination, a comprehensive examination, and a final oral examination. A doctoral dissertation on an appropriate topic is required. It must be a well-organized account of research undertaken by the student and show initiative and originality. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. A minimum grade-point average of 3.00 for work done at the University is required for admission to the qualifying examination, the comprehensive examination, and the final oral examination, and for graduation. Graduate Council requires the student to have a high level of competence in the reading, writing, listening, and speaking of English before the Comprehensive Examination is scheduled.