Engineering Mechanics and Engineering Mechanics with Astronautics Option

A Guide for Undergraduate Majors

Last modified Fall 2017

This guide applies to students entering the program after August 2017. Students admitted prior to this should continue to follow the Student Guide in effect when they entered the program. They may petition the department to select features of the new curriculum.

Administered by the

Department of Engineering Physics

153 Engineering Research Building, 1500 Engineering Drive, Madison, WI 53706-1609
Phone: (608) 263-1646, Fax: (608) 263-7451, Internet: *www.engr.wisc.edu/ep/*

Introduction

The **Engineering Mechanics (EM**) Program is administered by the **Department of Engineering Physics**. The Department Office is room 151, Engineering Research Building (ERB). The department also administers the **Nuclear Engineering (NE)** and the **Engineering Physics** (**EP)** undergraduate programs.

This guide is intended to provide **Engineering Mechanics (EM)** undergraduate students with information that will facilitate their studies at the University of Wisconsin-Madison. In addition to this guide, you should consult the **Undergraduate Catalog** (http://www.wisc.edu/pubs/ug/) for regulations and course descriptions in engineering.

The **Engineering Physics** web site is at https://www.engr.wisc.edu/department/engineering-physics/ From there you can follow links to specific sections for **EM** students. The **College of Engineering** (**COE**) web site (https://www.engr.wisc.edu) also provides information for engineering students.

We welcome you to the **Engineering Mechanics** Program, and wish you a successful undergraduate experience!

Bachelor of Science in Engineering Mechanics

The undergraduate program in **Engineering Mechanics** provides its graduates with the broad scientific background necessary for exploring fundamental design and research questions in many fields of engineering. Graduates interact effectively with chemists, physicists, mathematicians and engineers on interdisciplinary projects and programs in a diverse variety of industrial and government organizations. Their tasks may include developing or modifying analytical or experimental models; or solving problems in the newly emerging areas of engineering for which standard methods, formulas or materials have not yet been developed.

The **Engineering Mechanics** Program contains a relatively large number of elective credits available during the latter part of the curriculum giving students excellent flexibility for pursuing their own personal interests and professional goals.
With the help of an advisor, the student participates continuously and effectively in planning his/her educational program. Upon completion of the common core of courses taken during the freshman and sophomore years, a student is well prepared to emphasize one of the many areas of special interest within the Department or to pursue the Astronautics degree option. With the variety of elective courses available during the remaining part of the **Engineering Mechanics** Program, the student is given maximum flexibility in pursuing an area of special interest. These include:

- Structural Mechanics
- Dynamics and Vibrations
- Applied Mathematics and Numerical Methods
- Experimental Mechanics and Materials

Remember, it is up to you and your advisor to put together a coherent program that satisfies all the requirements. Your advisor is there to help you, so seek out his or her assistance.

The **Engineering Mechanics** Program provides an excellent preparation for graduate study in a variety of engineering and scientific disciplines. The opportunity is also available to use the liberal studies and free electives of the curriculum as preparation for entrance into law, medical or business schools after graduation.

Astronautics Option

Aerospace engineering is an extremely broad area of engineering encompassing the research and development frontiers of nearly all areas of engineering and science. Aerospace engineering is frequently discussed in terms of its two major areas, namely aeronautics and astronautics. These two areas are not mutually exclusive and include many common fundamental disciplines, such as structures, modern materials, and flight mechanics.

The major focus of our program is on astronautics, which relates to rocket, satellite and spacecraft design, while aeronautics, which deals with aircraft design, has a more modest emphasis. However, graduates of our program are widely employed by aircraft companies because of the commonalities in these disciplines. The Astronautics option provides an excellent background for a wide variety of interesting and exciting jobs in industry and government laboratories. It also serves as excellent preparation for graduate study in a wide range of aerospace disciplines and other high-technology areas.

The Astronautics Program provides students with opportunities for research, development and design careers in a wide variety of aerospace disciplines. In the area of designing aerospace structures, students learn contemporary methods of analytical and experimental stress analysis, structural dynamics, vibrations and computer analysis. In the latter case, a knowledge of finite element methods is currently in great demand in the aerospace industry. Students have opportunities to study fatigue, fracture mechanics and composite materials, all areas of importance and concern to aerospace companies.

In the area of spacecraft dynamics, all students study orbital mechanics, transfer orbits, lunar and interplanetary trajectories, rocket dynamics, vibrations, gyroscopic instruments, control systems, aerodynamics and dual spin satellites. In addition, students have the opportunity to study space propulsion, flight mechanics and robotics, all at the advanced undergraduate level. Astronautics students often extend their education by co-oping with aerospace companies and federal agencies such as NASA.

The capstone design sequence scheduled for the senior year provides students with excellent opportunities to apply knowledge gained in various courses to aerospace related design projects.

Students completing the Astronautics option receive the B.S. in Engineering Mechanics, with the Astronautics option noted on the student's transcript. The Astronautics option can be selected by filling out an **Option Declaration Form** available in the Student Services Center, 1410 Engineering Drive, Suite 170.

Career Opportunities

Graduates of the **Engineering Mechanics** Program are sought by most industries and government agencies. Typical examples of project areas requiring engineers with a broad science and engineering background and with an emphasis in applied mechanics are outlined below:

Development of improved experimental, analytical and engineering methods as well as new materials for automobiles, air/spacecraft, submarines, high-speed rail systems, and other moving vehicles for improved safety, strength, and reliability.

Design of new types of structures projected for future needs, such as advanced energy systems, cryogenic structures, space stations, undersea structures and earthquake resistant installations.

Dynamic and vibrational design of rotating machinery such as aircraft engines, high-speed gas and steam turbines, spinning disks for digital information storage, aircraft and automotive tire applications, and high-speed rotating drums and pumps.

Development of innovative experimental methods for studying machines, structural components and materials where new and unusual design conditions are encountered, such as very high or low temperatures, vibrational and repetitive loads, impact situations, moving loads, large magnetic or electrical fields, and biomedical environments.

Development of new theories, methods of analysis and computational techniques for treating unusual advanced design problems in engineering which may require higher levels of mathematics and computer training.

Research, development and testing of new materials such as metals, ceramics, composites, and plastics, to meet the changing requirements of the future that will be encountered in designing advanced energy systems, extremely high speed machinery, nonmetallic substitutes, micromachines and biomedical apparatus. Advanced engineering in the research and development programs of major industries such as the automotive, aerospace, computer, construction, farm equipment, home appliances, industrial machinery, nuclear, oceanographic, petroleum, tire and rubber, plastics and paper.

Objectives and Expected Outcomes

Whatever path our graduates choose to pursue, our educational objectives for the nuclear engineering and engineering mechanics programs are to allow them to:

1. Exhibit strong performance and continuous development in problem-solving, leadership, teamwork, and communication, initially applied to nuclear engineering or engineering mechanics, and demonstrating an unwavering commitment to excellence.
2. Demonstrate continuing commitment to, and interest in, his or her training and education, as well as those of others.
3. Transition seamlessly into a professional environment and make continuing, well-informed career choices.
4. Contribute to their communities.

Engineering Mechanics Program students are expected to have…

1. An ability to identify, formulate, and solve engineering problems. This includes:
    a. An ability to apply knowledge of basic mathematics, science and engineering
    b. An ability to use advanced mathematical and computational techniques to analyze, model, and design physical systems consisting of solid and fluid components under steady state and transient conditions.
    c. An ability to design a system, component or process to meet desired needs.
    d. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. An ability to function on multi-disciplinary teams.
4. Knowledge of professional and ethical standards.
5. An ability to communicate effectively.
6. The broad education necessary to understand the impact of engineering solutions in a global and societal context.
7. A recognition of the need for, and ability to engage in life-long learning.
8. A knowledge of contemporary issues.

Curriculum Requirements

The curriculum applies to students who entered the program after Fall 2017 Students admitted prior to this may petition the department to select features of the new curriculum. For curriculum requirements prior to Fall 2017 see earlier versions of this document.

Requirements for Admission and for Continued Enrollment for Students Entering in Fall 2017

Students who begin this program after August 2017 will be required to meet the requirements described below.

To continue in a College of Engineering (CoE) degree program after direct admission or to be considered for admission to a CoE degree program after enrollment at UW-Madison as part of another classification, students must complete the following requirements after one year of residency at UW-Madison:

1. Complete at least four core courses at UW-Madison, as follows (all math and science courses as qualified below will constitute the core GPA):
    a. Math: A minimum of two math courses 217 or above (excludes math 228 and math 473); or one math 300 level or above; not including special topics, independent study or seminar courses.*
    b. Science: A minimum of two science courses as shown below.

       For students continuing or seeking admission to other undergraduate degree programs in the CoE:
       (i) one course must be either Chemistry 104 or higher OR physics 201/EMA 201 or higher
       (ii) one other science course, from the following**:

       - Chemistry, all classes
       - EMA 201, EMA 202, ME 240
       - Physics 201 and above
       - Calculus-based Statistics 224 and above
       - EP 271
       - Computer Science 302 or above, excluding CS 304
       - not including special topics, independent study or seminar courses.

    c. For one and only one of these courses that a student has repeated, the more recent of the two grades will be used in the calculation of core and overall GPA's.
    d. Core GPA: All courses that satisfy (a) and (b) above and any departmental engineering courses 200 or above taken (not including special topics, EPD, InterEGR, independent study or seminar courses) during the first year will be counted in the core GPA.

*If the math requirement for the degree program is completed upon entry at UW-Madison then additional courses from section (b) can also be completed for a minimum of 4 core courses (not including special topics, EPD, InterEGR, independent study or seminar courses)

**If the math and science requirement for the degree program is completed upon entry at UW-Madison then departmental engineering courses 200 or above can also comprise the minimum 4 core courses (not including special topics, EPD, InterEGR, independent study or seminar courses).

2. Complete the General Education Communications Skills Part A requirement (placement test, AP/IB or transfer credit may be used). If Comm. A is completed prior to attending UW-Madison, then a 3 credit liberal studies course (with a breadth designation of H, L, S, or Z) must be taken on a traditional graded basis at UW-Madison. Independent studies and seminar courses may not be included.
3. Complete the Introduction to Engineering (InterEGR 110) and Design Practicum (InterEGR 170) or an Introduction to Engineering course (ME 151, ECE 252, GLE 171, NavSci 301).
4. Successful completion of math through Math 222 or Math 276
5. At least 24 credits including English as a Second Language courses if needed, completed at UW-Madison. Independent study, special topics, seminar courses, pass/fail or credit/no credit courses will not be included in the 24 credits.

6. After one year of residency at UW-Madison, for students to continue within a CoE degree granting program or to move from EGR to a degree granting program, students must meet Core and Overall GPA as defined by departmental curricula and must not be on academic probation for GPA reasons at time of consideration. Please contact your advisor if you have questions.
    a. The minimum Core GPA for the Engineering Mechanics and Engineering Mechanics with Astronautics option is 3.2.
    b. The minimum Overall GPA for this program is 2.5.
7. Students who are making satisfactory progress but do not meet above requirements in one-year may apply for a one-semester extension up to their fourth semester. Extensions will be considered only in cases where it is mathematically possible during the extension to meet requirements.
8. Students cannot remain in their departments or in EGR status beyond their 4th semester without completing above requirements.
9. Students who do not meet automated admission under the rules of this section and who are within 0.30 grade points of the Core GPA requirements indicated in Rule 6 and/or have experienced significant extenuating circumstances impacting student's core GPA are encouraged to file an appeal of the admission decision. An appeal will trigger a holistic review process, which will include appeal statement, course rigor and grade trends.

A more in-depth discussion of the progression requirements can be found at the following weblink: https://www.engr.wisc.edu/academics/student-services/academic-advising/first-year-undergraduate-students/progression-requirements

Engineering Mechanics

Suggested Sequence

Fall Semester	Cr	Spring Semester	Cr
Freshman Year			
Chem 109 Advanced General Chemistry I[1]	5	EMA 201 Statics[3]	3
Math 221 Calculus & Analytic Geometry	5	Math 222 Calculus & Analytic Geometry	4
Communications "A" Elective	3	Stat 224 or Stat 324	3
InterEgr 170 Design Practicum[2]	2	ME 231 Graphics	2
InterEgr 110 Intro to Engineering	1	Liberal Studies Electives	3
Total	**16**	**Total**	**15**
Sophomore Year			
Math 234 Calculus-Fn. of Several Variables	4	Math 320 Lin. Alg. & Diff. Eq.[9]	3
Physics 202 General Physics	5	Physics 241 or Physics 205 Modern Phys.	3
EMA 202 Dynamics	3	ME 361 Engineering Thermodynamics	3
EP 271 Engr. Prob. Solving I[4]	3	EMA 303 Mechanics of Materials[5]	3
EPD 275 or CA 105 Public Speaking	2	EMA 307 Mechanics of Materials Lab	1
Total	**17**	Liberal Studies Electives	3
		Total	**16**
Junior Year			
EMA 506 Adv. Strength of Materials	3	EMA 405 Practicum in Finite Elements	3
EMA 542 Adv. Dynamics		Experimental Mechanics Course[7]	3
or EMA 545 Vibrations[6]	3	ME 363 or CEE 310 Fluid Mechanics	3
Math 321 App. Math Analysis[9]	3	Computing Elective	3
MS&E 350 Intro. to Materials Science	3	Technical Electives	3
EPD 397 Technical Writing	3	**Total**	**15**
Liberal Studies Elective	3		
Total	**18**		
Senior Year			
EMA 469 Design Prob. in Engineering	3	EMA 569 Senior Design Project	3
EMA 521 Aerodynamics[8]	3	EMA Electives	6
EMA Electives	3	ME 364 Heat Transfer	3
ECE 376 Electrical Circuits or Phys 321	3	Liberal Studies Elective	3
Liberal Studies Electives	4	**Total**	**15**
Total	**16**		

Total Credits Required for Graduation: 128

1. Students should take Chem 109, 5 cr; students with inadequate preparation in high school chemistry may substitute Chem 103 and 104, for a total of 9 credits.
2. Students who were not able to take InterEgr 170 as freshmen may, with the approval of their advisor, substitute 2 credits of electives from courses offered in the College of Engineering or in the Departments of Chemistry, Computer Science, Mathematics, and Physics.
3. Students may substitute Phys 201, 5 cr., for EMA 201, 3 cr., with the approval of their advisor.
4. Computer Science 310 is an acceptable substitute for EP 271.
5. Students must receive approval from their advisor to substitute ME 306 for EMA 303.
6. Students electing EMA 545 instead of EMA 542 should note that EMA 545 is offered in the spring semester only.
7. EMA 611 or EMA 540 or EMA 570 or EMA 522. Note that EMA 540 and EMA 570 are typically offered in the Fall.
8. ME 563, Advanced Fluid Mechanics, may be substituted for EMA 521.
9. The sequence: Math 319 and 340 is an acceptable substitute for Math 320 and 321.

Astronautics Option in Engineering Mechanics

Suggested Sequence

Fall Semester	Cr	Spring Semester	Cr
Freshman Year			
Chem 109 Advanced General Chemistry I[1]	5	EMA 201 Statics[3]	3
Math 221 Calculus & Analytic Geometry	5	Math 222 Calculus & Analytic Geometry	4
Communications "A" Elective	3	Stat 224 or Stat 324	3
InterEgr 170 Design Practicum[2]	2	ME 231 Graphics	2
InterEgr 110 Intro to Engineering	1	Liberal Studies Electives	3
Total	**16**	**Total**	**15**
Sophomore Year			
Math 234 Calculus-Fn. of Several Variables	4	Math 320 Lin. Alg. & Diff. Eq.[9]	3
Phys 202 General Physics	5	Physics 241 or Phys. 205 Modern Phys.	3
EMA 202 Dynamics	3	ME 361 Engineering Thermodynamics	3
EP 271 Engr. Prob. Solving I[4]	3	EMA 303 Mechanics of Materials[5]	3
EPD 275 or CA 105 Public Speaking	2	EMA 307 Mechanics of Materials Lab	1
Total	**17**	Liberal Studies Electives	3
		Total	**16**
Junior Year			
EMA 506 Adv. Strength of Materials	3	EMA 545 Vibrations	3
EMA 405 Practicum in Finite Elements	3	EMA 550 Astrodynamics	3
ME 363 or CEE 310 Fluid Mechanics	3	EPD 397 Technical Writing	3
Math 321 App. Math Analysis[9]	3	ME 364 Heat Transfer	3
EMA 542 Adv. Dynamics	3	Computing Elective	3
Liberal Studies Electives	3	**Total**	**15**
Total	**18**		
Senior Year			
EMA 469 Design Prob. in Engineering	3	EMA 569 Senior Design Project	3
EMA 521 Aerodynamics[7]	3	EMA 642 Satellite Dynamics	3
Experimental Mechanics Course[6]	3	ECE 332 or ME 446 Control Systems[8]	3
ECE 376 Electrical Circuits or Phys 321	3	Technical Electives	3
Liberal Studies Electives	4	Liberal Studies Electives	3
Total	**16**	**Total**	**15**

Total Credits Required for Graduation: 128

1. Students should take Chem 109, 5 cr.; students with inadequate preparation in high school chemistry may substitute Chem 103 and 104, for a total of 9 credits.
2. Students who were not able to take InterEgr 170 as freshmen may, with the approval of their advisor, substitute 2 credits of electives from courses offered in the College of Engineering or in the Departments of Chemistry, Computer Science, Mathematics, and Physics.
3. Students may substitute Phys 201, 5 cr., for EMA 201, 3 cr., with the approval of their advisor.
4. Computer Science 310 is an acceptable substitute for EP 271.
5. Students must receive approval from their advisor to substitute ME 306 for EMA 303.
6. EMA 611 or EMA 540 or EMA 570 or EMA 522. Note that EMA 611 and EMA 522 are typically offered in the Spring.
7. ME 563, Advanced Fluid Mechanics, may be substituted for EMA 521.
8. The controls courses, ECE 332 and ME 446, have prerequisites not included in the Astronautics curriculum, but our experience is that Math 320 and EMA 545 provide sufficient background for these courses.
9. The sequence: Math 319 and 340 is an acceptable substitute for Math 320 and 321.

Electives Requirements

Liberal Studies Electives (16 credits)

Sixteen credits from the College of Engineering, the Institute for Environmental Studies, or the College of Letters and Science that carry H, S, L, or Z *Class Search* (formerly *Timetable*) breadth designators must be taken to fulfill the Liberal Electives Requirements. These credits must fulfill the following sub-requirements:

I. A minimum of two courses must be from the same department or program. At least one of these two courses must be above the elementary level (i.e. must have I, A, or D level designator), as indicated in Class Search.

II. A minimum of six credits must be in courses designated as humanities (H, L, or Z), and an additional minimum of three other credits designated as social studies (S or Z). Foreign language credits count as H credits.

III. At least three credits must be in courses designated as ethnic studies (lower case "e" in Class Search). These credits may help satisfy regulations I or II as well, but may count only once toward the total credits required.

Communication Skills "A" Requirement (3 cr)

Students must take one course from the following list:

Eng 100	Freshman Composition	3 credits
Comm Arts	100 Introduction to Speech Composition	3 credits
Ag Journ 100	Introduction to Communication	3 credits
ILS 200	Critical Thinking and Expression	3 credits

Many students find it useful to take the Communication "A" elective and InterEgr 170 concurrently in the fall semester of their freshmen year.

Communications "B" Elective

This requirement is automatically met by EPD 397, which is a required course. Other Communication "B" courses may be substituted upon approval of the department chair.

Computing Elective (3 cr)

Students need one course from the following list:

CS 300	Programming II	3 credits
CS 412	Introduction to Numerical Methods	3 credits
EP/EMA 471	Engineering Problem Solving II	3 credits
EP/EMA 476	Computational Engineering	3 credits

Technical Electives (3 cr)

Students need 3 credits at an academic level that requires 2 semesters of calculus or 2 semesters of physics as a prerequisite. EMA 001, Cooperative Education Program, may also be used to satisfy this requirement.

Engineering Mechanics Electives

(9 credits in the standard program, none in the astronautics option)

Courses meeting the **Engineering Mechanics** Electives requirement are all EMA courses numbered 500 and above. No more than 3 credits of EMA 599, Independent Study, may be used to meet this requirement.

Special Programs for Engineering Mechanics Students

The Department offers four special programs for **Engineering Mechanics** students. The **Scholars** Program and the **Distinguished Scholars** Program provide increased flexibility for students wishing to develop an individualized curriculum. The **Honors in Research** Program is designed for students who want to get involved in research and receive recognition on their diploma and transcript. It is highly recommended for students contemplating graduate study.

Scholars Program

Students who have completed the first semester of study specified in the regular curriculum and who have achieved a 3.0 GPA may request admission to the **Scholars** Program. With the approval of the student's advisor and the **EP** Department Chair, a student in this program may be exempted from specific course requirements except for the following:

1. The total number of credits required is 128;
2. At least 51 credits must be in engineering sciences, and these 51 must include EMA 469 and 569 plus at least 12 more credits of EMA courses. (Computer Science courses may be counted as engineering science);
3. At least 19 credits must be in mathematics courses;
4. At least 13 credits must be in physics and chemistry;
5. The Liberal Studies requirements (page 9) must be met;
6. The Communications "A" Elective (page 9), EPD 275 or CA 105, and EPD 397 must be satisfied. A student in this program must maintain a cumulative GPA of 3.0, and the main thrust of the academic work must be in **Engineering Mechanics and Astronautics**.
7. Later entrance into this program is permitted for **EMA** students who have followed the prescribed **B.S. EM or EMA** curricula and have a cumulative GPA of 3.0. Students on the Madison campus may enter the program late as the beginning of the fifth semester. Students transferring from other institutions may enter as late as the beginning of the seventh semester provided their GPA for the first on-campus semester is at least 3.0.
8. To apply for the **Scholar's** Program, obtain, sign and submit an **Option Declaration Form** to the Student Services Center for EMA in 1410 Engineering Drive, Suite 170.

Distinguished Scholars Program

EMA students who achieve a 3.70 GPA or above for the first two semesters on campus may request admission to the **Distinguished Scholars** Program. This program provides increased flexibility for students wishing to develop an individualized curriculum. Necessary stipulations are that the student maintains a cumulative GPA of 3.5 or greater and that the main thrust of academic work be along the lines of **Engineering Mechanics and Astronautics** education.

The "thrust of **Engineering Mechanics and Astronautics** education" incorporates several concepts that the student must recognize:

1. The established undergraduate curriculum has been developed after much effort and over a period of many years to meet the student's needs. The Distinguished Scholar should choose carefully before omitting any of the required courses in the curriculum.
2. The course EMA 469 and 569 are the culmination of the undergraduate curriculum. It requires the student to integrate and apply knowledge obtained from most of the required technical courses to a design experience. It is the culmination of all the design content in the curriculum, design being a critical aspect of engineering education. To meet this requirement, the **Distinguished Scholar** must complete EMA 469 and 569 or choose an acceptable substitute fully satisfactory to the student's advisor and the **EP Department Chair.**
3. The student should bear in mind that laboratory experiences are important parts of engineering education; the student is urged to complete a suitable experimental mechanics laboratory course.

4. The Liberal Studies requirement (page 9) must be satisfied.
5. The Communications "A" Elective (page 9), EMA 275 or CA 105, and EPD 397 must be satisfied.
6. The total number of credits required is 128.

Later entrance into the **Distinguished Scholars** Program is also permitted. A student may transfer into the Department from any other department on the Madison campus as late as the beginning of the fifth semester (or from any other institution as late as the beginning of the seventh semester) and still qualify for this program. A student may enter the program as late as the beginning of the fifth semester provided:

1. A course schedule closely equivalent to that contained in the **B.S. EM or EMA** curriculum has been pursued;

2 The cumulative GPA is equal to or greater than 3.70 after two semesters, 3.60 after three semesters, or 3.50 after four semesters; and

3. If transferring from off the Madison campus, the GPA for the first semester of on-campus courses is equal to or greater than 3.50.

To apply for the **Distinguished Scholar's** Program, obtain, sign and submit an **Option Declaration Form** to the Student Services Center for EMA in 1410 Engineering Drive, Suite 170.

Undergraduate Honors in Research Program

Expectations for Honors in Research Projects

The research should be such that the student participates in the creation of new knowledge, experiences the excitement of the research process, and makes a contribution so that it would be appropriate to include the student's name on scholarly publications resulting from the research. The research need not be an independent effort by the student, but can be participation in a larger team effort, as long as it meets the criteria above.

Admission Requirements

At least two semesters completed on the Madison campus with a cumulative GPA of at least 3.5.

Admission Process

The student should identify and obtain the concurrence of an appropriate professor to serve as his/her thesis advisor. The student should submit a letter to the **Engineering Physics Department** chair requesting admission, stating the approximate topic of his/her proposed research, and identifying the proposed thesis advisor under whose guidance he/she will be working. The topic should be appropriate to the major. A letter from the proposed thesis advisor supporting the application should be included.

Academic Credit

Students register for credit in Honors in Undergraduate Research (EMA 489). Students may register for 1 to 3 credits per semester. A grade of "P" (Progress) will be assigned each semester until the student completes the senior thesis or drops out of the program, at which time a final grade is assigned. This becomes the grade for all credits taken in EMA 489.

Senior Thesis

A senior thesis worth 3 credits of EMA 489 is required. The senior thesis is a written document reporting on a substantial piece of work. It should be written in the style of a graduate thesis. The thesis advisor determines the grade, which the student receives for the thesis. A bound copy of the thesis should be submitted to the **Engineering Physics Department** Office.

Before the end of the last semester of undergraduate studies, the senior thesis should be presented by the student to a committee of three professors in a publicly announced seminar. Interested faculty and students will be invited to attend.

Honors Designation

"Honors in Research" designation will be awarded to graduates who meet the following requirements:

1. Satisfaction of requirements for an undergraduate degree in either Engineering Mechanics or Nuclear Engineering.
2. A cumulative grade-point average of at least 3.3.
3. Completion of a senior honors thesis (3 credits of EMA 489) with a grade of B or better.
4. Completion of a total of at least 8 credits in EMA 489.

Recognition

The designation, "Honors in Research" will be recorded on the student's transcript and diploma.

Advising

First year NE students will be assigned an advisor from the CoE Student Services Center, 1410 Engineering Drive, Suite 170. Continuing students who have fulfilled the progression requirements (page 5) will be assigned an NE faculty advisor starting with their second year.. **Students retain the same advisor until graduation, even if they do not progress in class standing at the normal rate.** The list of faculty advisors is available in the Department office. Before enrolling in courses each semester, student must meet with their faculty advisor for assistance in planning courses and meeting degree requirements. **Students must consult with their advisor and turn in their course advising form to the Student Services Center before enrolling for the semester. A hold well be placed on students' accounts to prevent enrollment until this form is received.**

Wait Listed Courses: In any given semester, courses may fill up quickly depending on demand. Some courses may have a wait-list established through the enrollment system. Students will be notified by email if they have been given permission to enroll from the wait-list. The department will assist students in enrolling for the courses they need. However, there is no guarantee that students will be allowed into a wait-listed section. If it is an EMA, EP, or NE course, contact the Student Services Center to see if additional sections will be opened or if the registration enrollment will be raised. Also, see your advisor about other options available to you.

Grievance Procedure

Students who feel that they have been treated unfairly have the right to a prompt hearing of their grievance. Such complaints may involve course grades, classroom treatment, advising, various forms of harassment, or other issues. Any student or potential student may use these procedures.

Procedures for proper accounting of student grievances:

- The student should speak first with the person toward whom the grievance is directed. In most cases, grievances can be resolved at this level.
- Should a satisfactory resolution not be achieved, the student should contact the program's Grievance Advisor to discuss the grievance. The Graduate Program Coordinator can provide students with the name of this faculty member, who facilitates problem resolution through informal channels. The Grievance Advisor is responsible for facilitating any complaints or issues of students. The Grievance Advisor first attempts to help students informally address the grievance prior to any formal complaint. Students are also encouraged to talk with their faculty advisors regarding concerns or difficulties if necessary. University resources for sexual harassment concerns can be found on the UW Office of Equity and Diversity website.
- If the issue is not resolved to the student's satisfaction the student can submit the grievance to the Grievance Advisor in writing, within 60 calendar days of the alleged unfair treatment.
- On receipt of a written complaint, a faculty committee will be convened by the Grievance Advisor to manage the grievance. The program faculty committee will obtain a written response from the person toward whom the complaint is directed. The response will be shared with the person filing the grievance.

- The faculty committee will determine a decision regarding the grievance. The Grievance Advisor will report on the action taken by the committee in writing to both the student and the party toward whom the complaint was directed within 15 working days from the date the complaint was received.
- At this point, if either party (the student or the person toward whom the grievance is directed) is unsatisfied with the decision of the faculty committee, the party may file a written appeal. Either party has 10 working days to file a written appeal to the College of Engineering.
- Documentation of the grievance will be stored for at least 7 years. Significant grievances that set a precedent will be stored indefinitely.

The Graduate School has established policies governing student conduct, academic dishonesty, and sexual and racial harassment. The Graduate School also has procedures for students wishing to appeal a grievance decision made at the college level. These policies are described at http://www.students.wisc.edu/doso/.

DARS Reports

The DARS (Degree Audit Reporting System) report is a computer generated record of courses you have taken and where you stand relative to degree requirements. It is an aid to help you and your advisor in tracking your progress towards graduation. This record can be obtained through your **MyUW** website. You should be aware that the DARS report is **unofficial** and may contain errors. **You should check your DARS report on a regular basis for errors and bring them to the attention of your advisor**, so that a correction can be made. Your record will still be subject to an audit at graduation.

Tips to Help You

Independent Study - EMA 599

Undergraduate students are strongly encouraged to enroll in EMA 599 Independent Study, to gain exposure to research. This will broaden the mental horizons of the student participants, will help those wondering about graduate study to make a decision, and will help those aimed towards graduate study to compare areas of research. Students work on research projects under the guidance of a professor. Together they agree on the work to be done and the number of credits earned (usually 1-3) per semester. Up to 3 credits of EMA 599 may be used as **Engineering Mechanics** electives.

Co-op/Internship Program

The Co-op/Internship program is an excellent way to get engineering experience while working in a company, either for a summer or a semester. Many students have found these programs extremely valuable in enhancing their education and are frequently in a favored position to gain employment with the company after graduation. Consult the Engineering Career Services office, 1st Floor, 1410 Engineering Drive, for further information. Academic credit is earned through EMA 001; up to 3 credits may be used as a technical elective.

Study Abroad

Research is an increasingly global activity and developing global competency is important for engineers. One way to improve global competency is to take part in a Study Abroad experience. Roughly a quarter of EP majors take part in a study or work abroad experience prior to graduation. More detailed information about opportunities can be found at:
https://www.engr.wisc.edu/academic/beyond-the-classroom/study-abroad/

Hourly Work

Working on research with a faculty member in the Department is a very valuable experience for undergraduates. A number of undergraduates are employed by faculty members either under the work-study program or on research grants. Students are encouraged to explore such opportunities by talking to members of the faculty.

Letters of Recommendation

The letters of recommendation you will request as a senior will have a significant effect on your job opportunities, salary offers,

graduate fellowship opportunities, admission to graduate schools, and so on. It is important that the writers of such letters be able to say that they know you well. Therefore, it can be very much worth your effort to ensure that one or two of the instructors you have had, advisors, or faculty employers know you really well. For example, you might do an extra project for an instructor in a course, you might work as a student hourly employee in a laboratory, and you might take independent-study courses, or you might volunteer for Engineering Expo or other activities, which will favorably call you to the attention of faculty. Obviously, participating in class discussions and asking many intelligent questions is also helpful.

Statistics

The curriculum requires Statistics 224, but you may want to take a more challenging course, Statistics 324, instead; if so, a substitution can be requested from your advisor.

Professional Registration

Most states license professional engineers. Registration as a professional engineer is a requirement for some jobs and generally increases the earning power and responsibility of the licensed individual. The registration process requires exams on Fundamentals of Engineering (FE) and on the principles and practice of engineering. Seniors can usually pass these tests easily and are urged to take them. Information may be found on the bulletin board outside the Department Office or may be obtained from: Wisconsin Department of Safety and Professional Services, 55 N. Dickinson St., Madison, WI 53703, phone 608-266-2112, http://dsps.wi.gov/Home; NCEES, http://ncees.org/, has information and study guides for the FE exam. Be aware that the FE exam is given **only in April and October**, and the deadline for filing applications is typically a few months earlier. Therefore, students should begin planning for the exam while they are still juniors.

Special Graduation Requirements

Students should particularly note the requirements for graduation given in 34b, c, and f of the "Official Regulations Regarding Enrollment, Scholarship, and Graduation for Undergraduates in The College of Engineering of University of Wisconsin-Madison." This can be found under the "graduation" tab in the Student Services section of the College of Engineering webpage (https://www.engr.wisc.edu/academics/student-services/academic-advising/undergraduate-engineering-students/how-do-i/rules-and-regulations/) . Among other requirements paragraph 34 specifies GPA requirements for the last 60 credits, for courses taken in your major, and for the student's last semester and last two semesters.

Credit for Previous College Work

Students who have done college level work elsewhere can usually transfer credits earned at other colleges. Contact the Student Services Center, 1410 Engineering Drive, Suite 170, to discuss a transfer of credits. In addition, there is the possibility of having prerequisites waived, of having course requirements waived, or of receiving course credit. Generally, prerequisites can be waived by the instructor teaching the course. The Department Chair can waive course requirements, and the department that offers a course can give credit for one of its courses either by examination or on the basis of evidence of equivalent work.

Scholarships and Financial Aid

Most financial assistance is awarded through the Office of Student Financial Aid (333 E. Campus Mall RM 9701, 262- 3060). Some financial assistance is also available from the College of Engineering. Please see your academic advisor or Student Services Center, 1410 Engineering Drive, for more information. The Department has a limited amount of scholarship funds awarded on a merit basis, usually at the beginning of the fall semester. An application for departmental scholarships is not necessary; all students are automatically considered in the competition for departmental scholarships.

The Wisconsin Space Grant Consortium and the American Institute for Aeronautics and Astronautics award scholarships to EM students; see the AIAA advisor, Prof. Dan Kammer (539 ERB, 262-5724, dckammer@engr.wisc.edu), for further information.

Graduate Study

M.S. and Ph.D. in Engineering Mechanics

The Department offers the Master's of Science and Doctor of Philosophy degrees in Engineering Mechanics. Students interested in graduate work in EM at Wisconsin can find more information at the EM Graduate Program website,

www.engr.wisc.edu/department/engineering-physics/academics/ or from The Academic Policies and Procedures for Graduate Work in Engineering Mechanics available in the Department Office. Additional information about opportunities and financial aid may be obtained at http:/grad.wisc.edu/studentfunding/prospective/. Information from other graduate schools is available on the bulletin board outside the Department Office, in the library, and at the Graduate School office in Bascom Hall.

Graduate Record Examination

Students planning to enter graduate school should take the GRE in the fall of their senior year. This exam is required by many graduate schools and for most graduate fellowships. Details may be obtained from the Graduate School Fellowships Office, 217 Bascom Hall.

Special Programs

There are several Certificates available in the College of Engineering:

- Biology in Engineering Certificate
- Certificate in Energy for Energy Sustainability
- Certificate for Engineering Thermal Energy Systems
- Certificate in Integrated Studies in Science, Engineering and Society
- Certificate in International Engineering
- Certificate in Japanese Studies for Engineering Majors
- Certificate in nuclear Engineering Materials
- Certificate in Technical Communications

Some of the available options are highlighted below.

Engineering Honors in the Liberal Arts

The Engineering Honors in the Liberal Arts program is designed for engineering students with unusual ability and interest in the liberal arts and who desire access to the special honors sections open to L&S honors students. For further information, see https://www.engr.wisc.edu/academics/undergraduate-academics/honors/ or contact the Engineering General Resources office, Room 170, CAE, 1410 Engineering Drive.

Certificate in Technical Communications

The completion of approximately 15 elective credits in oral communication and technical writing leads to a Certificate of Technical Communication; the award is noted on the student's transcript. Representative courses include EPD 397 "Technical Writing," EPD 398 "Technical Communications Internship," EPD 275 "Technical Presentations," EPD 395 "Elements of Computer-Assisted Publishing," and CA 464 "Theory and Practice of Persuasion." The program will help students become better communicators as Engineers or will prepare them to pursue careers in technical writing. For further information, see http://tc.engr.wisc.edu/certificate/ or contact the Department of Engineering Professional Development (432 North Lake Street, Madison, WI, phone 800-462-0876) for further information.

Certificate in Japanese Studies for Engineering Majors

The completion of the following courses leads to a Certificate in Japanese Studies for Engineering Majors; the award is noted on the student's transcript: East Asian 253 "Introduction to Japanese Civilization" (3 cr.); East Asian 103 and 104 "First and Second Semester Japanese" (12 cr.); EPD 374 and 375 "Technical Japanese I and II" (6 cr.); History 455 "Japan's Modern Century" (4 cr.); and Business 461 "Comparative Management in Asia" (3 cr.) or other courses in Japanese studies. The student should note that, of the total of 28 credits, at least 17 may qualify as Liberal Electives.
For further information, see http://tjc.engr.wisc.edu/certificate/ or contact Professor James L. Davis (Room M1056D Engineering Centers Building, 262-4810) for further information.

Letters & Science Second Major for Engineering Students

Many **EM** students can easily satisfy the requirements of the Mathematics or Physics Departments for a second major by choosing appropriate electives. Such a second major is recorded on the transcript. Second majors must be approved in advance, first by the

appropriate L&S department (by approval of a "Declaration of Major" form) and then by the Associate Dean of the College of Engineering. For details see the L&S Bulletin.

The requirements of the Physics Department for a second major are 30 credits of Physics courses plus a laboratory requirement. There are two options by which a student may satisfy the requirements of the Mathematics Department for a second major. For an **EM** student the simplest option requires six courses beyond Math 234, and the six must include Math 320 or 340 and at least two math courses numbered above 500. Consult with the appropriate department office for the latest requirements.

Additional Information

Department Colloquia

Colloquia are academic seminars on a broad field of study, usually led by a different lecturer at each meeting. The UW EM colloquia series presents the work of experts outside of the university to the faculty and students, broadening the understanding of the current scientific cutting edge, while presenting the university capability to the visitor. These lectures are announced on the Department bulletin board outside 153 ERB and the College of Engineering on-line calendar on the COE website. Colloquia are usually held on Tuesday afternoons at 4:00 PM (refreshments at 3:45 PM). Undergraduates are encouraged to attend.

AIAA Student Chapter

Undergraduates in both the standard **EM** Program and the Astronautics option are urged to join the *American Institute of Aeronautics and Astronautics*. This gives them an opportunity to meet other students, take an active part in organizing activities, meet visiting speakers, and hear talks in their fields presented on a level appropriate for undergraduates. Student involvement in such activities is viewed favorably by prospective employers. The AIAA advisor is Prof. Dan Kammer (539 ERB, 262-5724, kammer@engr.wisc.edu). The AIAA web site is at http://aiaa.slc.engr.wisc.edu

Society for Women Engineers (SWE)

The society of Women Engineers (SWE), founded in 1950, is a not-for-profit educational and service organization. SWE is the driving force that establishes engineering as a highly desirable career aspiration for women. SWE empowers women to succeed and advance in those aspirations and be recognized for their life-changing contributions and achievements as engineers and leaders. The SWE advisor is Carol Menassa (2205 EH, 890-3276, menassa@wisc.edu).
The SWE web site is at http://swe.slc.engr.wisc.edu

Engineering Expo

The Engineering Expo is a biennial event (held in spring of odd-numbered years) that gives the public a unique opportunity to learn about engineering. It is also a great learning experience for students, one that is highly regarded by employers. Students can contribute a few hours per semester or several hours per week - from working on an exhibit to planning publicity. You might consider joining with the AIAA chapter and other students in preparing exhibits that demonstrate engineering mechanics and astronautics concepts. Interested students should speak with their advisor.

Some Friendly Advice

An alumnus who currently has the title of Manager at an important government facility expressed a view supported by others:

> *Engineers must be well rounded; a tremendous amount is expected of us by employers and the public. Communication skills, interpersonal relationships, team building, and positive attitude are essential for success.*
>
> *Tolerance for others' opinions (regardless of how misguided we may feel they are) is also extremely important.*
>
> *Transcending this there must be an inner commitment to excellence. I don't think this can be taught, but everyone must be challenged to excellence.*
>
> *Mediocrity should be sneered at, disdained - - - and never accepted. The faculty has a real challenge to motivate young engineers to not accept anything "half-way," anything less than excellence.*

Departmental Office Staff

Name	Title	Office	Phone	E-mail address
Douglass Henderson	Chair	153 ERB	263-0808	dlhender@wisc.edu
Dina Christenson	Human Resources	145 ERB	263-5966	dina.christenson@wisc.edu
Nancy Griego	Financial Records	439 ERB	263-2352	nancy.griego@wisc.edu
Tim Jensen	Communications Spec.	144 ERB	265-5092	timjensen@wisc.edu
Dennis Manthey	Dept. Administrator	146 ERB	263-1647	dennis.manthey@wisc.edu
Jesse Prochaska	Accountant	341 ERB	890-3580	jjprocha@wisc.edu
Kathy Wegner	Financial Specialist	503 ERB	263-8142	wegner@engr.wisc.edu

Student Services Center, 1410 Engineeering Drive, Suite 170; Phone: (608) 262-3471.

Reactor Lab Staff

Robert Agasie	Reactor Director	1209 ME	262-3392	agasie@engr.wisc.edu
Corey Edwards	Reactor Supervisor	1214 ME	890-1924	csedwards@wisc.edu

Engineering Physics Faculty

Name	Title	Office	Phone	E-mail
Matthew S. Allen	Associate Professor	535 ERB	890-1619	matt.allen@wisc.edu
Todd R. Allen	Professor	943 ERB	265-4083	todd.allen@wisc.edu
Vicki Bier	Professor (also IE/GNI)	3270A ME	262-2064	vicki.bier@wisc.edu
James P. Blanchard	Professor	2620h EH	263-0391	jake.blanchard@wisc.edu
Riccardo Bonazza	Professor	537 ERB	265-2337	riccardo.bonazza@wisc.edu
Adrien Couet	Assistant Professor	703 ERB	265-7955	couet@wisc.edu
Wendy Crone	Professor	543 ERB	262-8384	wendy.crone@wisc.edu
Raymond J. Fonck	Professor	333 ERB	263-7799	rjfonck@wisc.edu
Chris C. Hegna	Professor	521 ERB	263-0810	hegna@engr.wisc.edu
Douglass Henderson	Professor	153 ERB	263-0808	dlhender@wisc.edu
Roderick S. Lakes	Professor	541 ERB	265-8697	rlakes@wisc.edu
John Murphy	Faculty Assoc.	147 ERB	265-4186	john.murphy@wisc.edu
Sonny Nimityongskul	Faculty Assoc.	509 ERB		apnimityongs@wisc.edu
Jacob Notbohm	Assistant Professor	533 ERB	890-0030	jacob.notbohm@wisc.edu
Raluca Scarlat	Assistant Professor	931 ERB	890-4256	raluca.scarlat@wisc.edu
Oliver Schmitz	Associate Professor	341 ERB	263-1547	oschmitz@wisc.edu
Leslie Smith	Professor (also Math)	825 VV	263-3057	lsmith@math.wisc.edu
Carl R. Sovinec	Professor	519 ERB	263-5525	csovinec@wisc.edu
R. Thevamaran	Assistant Professor	539 ERB	262-5724	thevamaran@wisc.edu
Fabian Waleffe	Professor (also Math)	819 VV	262-3269	waleffe@math.wisc.edu
Paul Wilson	Professor	419 ERB	263-0807	paul.wilson@wisc.edu
Robert J. Witt	Associate Professor	531 ERB	263-2760	robert.witt@wisc.edu

Frequently Asked Questions

Where is my Professor's/TA's office and mailbox?

The EM faculty members have offices in the Engineering Research Building (ERB). Mailboxes are located on the first floor near the loading dock. The department TAs are also in the ERB; mailboxes are on the first floor near the loading dock. Check your course syllabus for your Professor's and TA's office number and office hours.

Where is the lost & found?

The Engineering Hall Lost & Found office is located in Room 1035 Engineering Hall, phone 263-5586. Occasionally, items are turned into the Department Office. The ERB Lost and Found office is located in Room 132C ERB, 263-1624 (the mailroom).

Does the department have a website?

Yes. The following websites provide helpful information;

Engineering Physics:	http://www.engr.wisc.edu/ep/
Nuclear Engineering and Engineering Physics:	http://www.engr.wisc.edu/ep/ne/
College of Engineering:	http://www.engr.wisc.edu/
AIAA chapter:	http://aiaa.slc.engr.wisc.edu
ANS chapter:	http://www.atomicbadger.org/