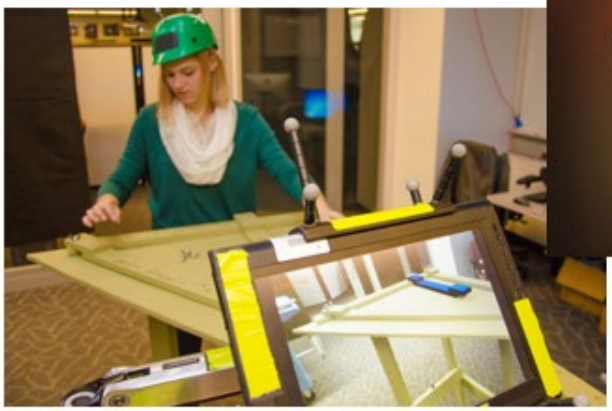
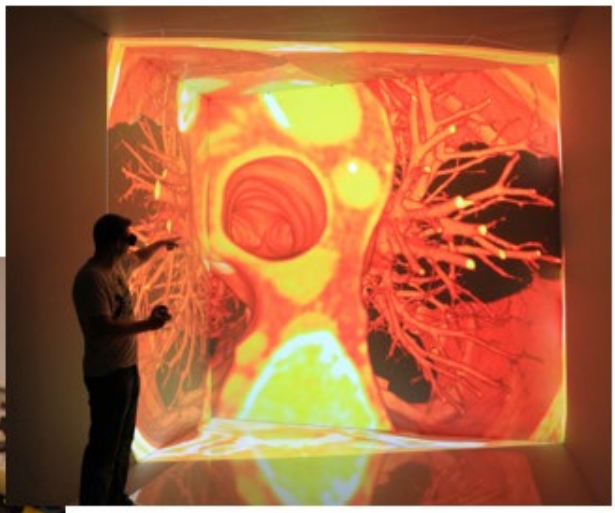
IOWA STATE UNIVERSITY
Department of Mechanical Engineering

Knowledge. Innovation. Leadership.

Energy Systems Engineering
Graduate Student Handbook





2019-2020

Department of Mechanical Engineering
Energy Systems Engineering interdisciplinary major
Iowa State University

Last updated: October 16, 2019

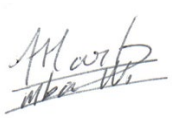
Welcome to the Energy Systems Graduate Program at Iowa State University. We are excited to have you join our vibrant program and are eager to help your graduate educational experience be an enjoyable and rewarding one.

The Energy Systems Graduate Program is hosted by the Department of Mechanical Engineering.

This student handbook is provided to give you general guidance about practices, policies and procedures related to your graduate career in our department and University. It is in accordance with the Graduate College Handbook which provides more detailed information on policies and can be found online at http://www.grad-college.iastate.edu/common/handbook/.

Since our Graduate Program continually seeks to improve, some changes may occur between annual printings of this handbook. Consequently, you should stay in close communication with your major professor at all times to verify important curricular and policy issues. We also encourage you to bring questions, comments and concerns to the Graduate Programs Office at any time. We look forward to helping you during your tenure here.

Best wishes,



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ADMISSION REQUIREMENTS

Admission to the Energy Systems Engineering Graduate program is contingent upon the following requirements:

- Bachelors of Science degree in Engineering OR Bachelors of Science degree, non-Engineering with:
  - 11 semester credits in math (through differential equations)
  - 16 semester credits in physics, chemistry and engineering sciences.
- International (non-English speaking) students need to take the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS).

Admission and application procedures can be found on the Graduate College website. Students may take up to 9 credits as a non-degree seeking student, so it is possible to begin your studies before formal admittance into the program.

CHAPTER 1 - STARTING OUT

1.1 Arrival and Check-in

International students must first check-in with the International Students and Scholars Office located in 3248 in the Memorial Union. Once you have checked-in with ISSO, you will need to check-in with the Mechanical Engineering Graduate Programs Office located in 2019 Black Engineering. Make sure to bring your packet from ISSO with you. Domestic students can check-in directly with the Mechanical Engineering Graduate Programs Office. You can find your way around campus using the online maps page at http://www.fpm.iastate.edu/maps/. We will give you a welcome package, instructions on procedures to complete before the semester starts and answer any questions may have.

New students or returning students who have not previously worked for the university will need to sign up for payroll in the Human Resources Office, 3810 Beardshear Hall. While in Beardshear, make sure you stop by Student Insurance (Rm 0570) to sign up for benefits. Please note that students on assistantships must have a signed Letter of Intent (LOI) on file with the ME graduate programs office before the start of semester. Your first paycheck for your assistantship or fellowship can be between two weeks to a month after you arrive due to procedural delays. Please plan for finances accordingly. You are able to set up your net-ID and email account through the Acropolis page (http://asw.iastate.edu).

1.2 Orientations

It is recommended that new graduate students in ESE attend ME Graduate Student Orientation event (usually the Friday before classes start) designed to introduce you to the M E department and its procedures as well as ease the transition to graduate study at Iowa State. This is a time to become acquainted with the Mechanical Engineering Graduate Program and its members, and to prepare for registration and the start of classes.

- International students should check with International Students and Scholars Office (ISS) for additional orientations (http://www.isso.iastate.edu)

1.3 English Requirement

Students whose native language is not English MUST take a special examination called the English Placement Test (EPT) to assess suitability for classroom education at ISU. This test is held the week before classes start. Further information can be found at http://engl.iastate.edu/ept/index.html. Students not passing this exam are placed in one or more of the courses in English 101 during the pre-registration process at orientation. These courses may be taken on a pass-not pass basis.

In addition international students having Teaching Assistantship (TA) appointments must also take the Oral English Certification Test (OECT) (http://acp.grad-college.iastate.edu/?q=node/15). Successful certification is required to assume TA duties so we ask that all international students complete the OECT within the first year.

1.4 Transportation

All bicycles must be registered with the university's parking division. Bikes must be parked in the provided bicycle racks. Bicycle racks are located throughout campus. Bikes are not permitted inside any university buildings. Registration (free for bicycles) can also take place online at http://www.parking.iastate.edu/permit/bike/.

CyRide is the Ames bus system. Students can ride all CyRide routes free of charge upon presentation of a current ISU card. During the school year, buses leave from most locations every 10-20 minutes. Schedules are widely available throughout the campus. Further Cy-Ride information can be found at http://www.cyride.com.

Student parking permits can be purchased through the Parking Division. You can learn more information about your permit options at http://www.parking.iastate.edu/permit. A copy of the ISU Traffic and Parking Regulations can be obtained from Public Safety, Parking Division, 27 Armory (also available online at http://www.parking.iastate.edu/about/). Consult the handbook section pertaining to students.

CHAPTER 2 – DEGREE PROGRAMS AND REQUIREMENTS

Each program consists of its own degree requirements. For a complete list of approved courses for each of the degree programs, please consult the appendices for the corresponding program.

2.1 Home Department

Since Energy Systems Engineering is hosted by Mechanical Engineering, your home department will be Mechanical Engineering. If you have another home department, then the ME Graduate Programs Office will only serve and support you in terms of the degree requirements.

2.2 Degree Requirements

2.2.1 Masters of Engineering in Energy Systems

A course-work only master's degree that allows practicing professionals the knowledge to deal with the increasing complexity of energy systems along with increasing environmental constraints. This program will provide additional education with the skills and abilities specific to energy system design, evaluation, construction and management. Includes the following requirements:

Degree Requirement	Credits	Description
Required courses	6	• ME 531: Advanced Energy Systems and Analysis (3 credits); offered on-line in fall semesters • ME 510: Energy Engineering Economics and Policy (3 credits); offered on-line in spring semesters
Math/Statistics	3	Any 400-level or higher Math or Statistics class or a class with significant math content from an approved list. (Appendix A)
Professional Development	3	Area of interest that meets the individual educational objectives of the student for professional development from an approved list. (Appendix B)
Elective Engineering courses	15	Courses in energy systems engineering from an approved list. Nine credits must be in a single focus area (biorenewables, wind, nuclear, power generation and distribution, building energy and energy efficiency, thermal science or as approved) (Appendix C) If the student's undergraduate degree did not include a course in thermodynamics, three (3) credits must be ChE 357, MatE 311, or ME 332 or the equivalent.
Free elective	3	Any class from the above categories.
Total:	**30**	

In order to be included on the approved course list, course content must be at least half "energy related". Energy related means content significantly covers any of the following in an engineering context:
(1) energy fundamentals, e.g., thermodynamics, heat transfer;
(2) energy production, transmission or utilization;
(3) design of energy production, transmission or utilization systems or components; (4) analysis of energy production, transmission or utilization systems or components.

2.2.2 Energy Systems Graduate Certificate

The Energy Systems Engineering Graduate Certificate consists of a minimum of **12 approved graduate credits**. Students must maintain a grade average of B or higher in all coursework.
If a student's undergraduate degree did not include a course in thermodynamics, three (3) credits must be ChE 381, MatE 311, or ME 332 or an equivalent thermodynamics course at another university. Completion of introductory courses may be required for no credit of students who are deficient in the respective course prerequisites.

Degree Requirement	Credits	Description
M E 531X: Advanced Energy Systems	3	Offered every fall
ME 510X: Energy Engineering Economics and Policy	3	Offered every spring
Electives	6	Two elective courses selected from a number of courses offered by different departments at ISU. (Appendix D) If a student's undergraduate degree did not include a course in thermodynamics, three (3) credits must be ChE 381, MatE 311, or ME 332 or an equivalent thermodynamics course at another university.

2.3 Graduate Minor in other disciplines

Students pursuing a mechanical engineering graduate degree may also pursue a minor in any discipline that has approved to grant a graduate degree. Pursuing a minor may be advantageous for students working on interdisciplinary projects with a particular emphasis on another specific discipline. A student may not minor and major in the same field. In all cases:

- the student must receive approval from and meet the minimum requirements established by the program offering the minor,
- a graduate minor must be comprised of graduate or undergraduate courses designated as appropriate by the program offering the minor,
- the student must have a minor representative on the POSC,
- on that committee, the major professor and the representative from the minor field may not be the same person, and
- a minor must be approved by the POSC, declared on the POSC, and listed on all examination reports and the "Application for Graduation" form in order to be eligible to appear on a student's transcript after graduation.
- a minor cannot be added to a degree that has already been received.

2.4 Online Learning Students

All the policies and procedures for the graduate program apply to students in the online learning program. The Engineering/LAS Online Learning staff and our Grad Programs Staff will be happy to assist you in preparing and routing forms for signatures.

2.5 Forms and Deadlines

It is your responsibility to fill out your forms and get signatures from your major professor first and then from your POSC members (when necessary). Attach any required additional materials and submit the

form to the ME Grad Programs Office Staff. Do not submit it directly to the DOGE. The staff will verify all information and obtain the DOGE's signature. If information on the form needs to be clarified or changed, you will be contacted. The graduate programs staff will inform you when the form is ready to be picked up from the office.

Deadlines for degree requirements can be found on the Graduate College calendar: www.grad-college.iastate.edu/calendar. Please plan to allow two days for processing and submit accordingly. Please treat the deadlines seriously. Failure to comply can and will result in delays to graduation, degree progress, and registration holds.

2.6 Failure to Maintain Academic Standing

Graduate students are expected to maintain a cumulative 3.00 grade point average on all coursework taken, exclusive of research credit. The Mechanical Engineering graduate program's policy for maintaining good academic standing is outlined below. The policies are in line with the Graduate College's policy.

2.6.1 Probation

New, first term, degree-seeking graduate students who fall below a 3.00 GPA at the end of their first semester at Iowa State University will be given a one term grace period to bring their grades back to a 3.00 GPA. Students may receive a warning letter from the Graduate College. While on academic probation a student will not be admitted to candidacy for a degree and if appointed to a graduate assistantship, the student will not receive a Graduate College tuition scholarship.

To insure that registration does not take place without a review by faculty in the program, the Graduate College places a hold on future registrations by a student on probation. Before a student on probation registers for each term, there must be a review of his or her record and the DOGE must recommend whether the Graduate College should permit further registration.

Before graduation is approved by the Graduate College, the student must complete all courses listed on the program of study with a minimum grade of C and have achieved a 3.00 GPA or greater. Exceptions must be recommended in writing by the student's POSC and DOGE and approved by the Dean of the Graduate College. Probationary status for more than two years is grounds for dismissal for failure to maintain academic standing.

CHAPTER 3 – THE GRADUATE PROGRAM OF STUDY AND COMMITTEE

In working towards a graduate degree, ME students must fulfill the requirements of both the Graduate College and the Department. These include developing a Program of Study and completing the graduation final check, as well as, meeting coursework and other general requirements. Graduate College requirements are discussed in more detail in the Catalog and the Graduate College Student Handbook (http://www.grad-college.iastate.edu/common/handbook/.

3.1 Major Professor

Masters of Engineering students are typically assigned the DOGE as their major professor to help guide their course selections – however they may choose a different major professor.

3.2 Program of Study and Committee (POSC) form

The POSC form includes the list of the courses the student proposes to take during their graduate study. Courses that appear on the POSC, and which are used to meet degree requirements, may not be taken in the pass-not pass system, and all courses used to meet degree requirements must appear in the Catalog. The POSC is submitted through the AccessPlus. As per the graduate council guidelines, POSC may not include more than three undergraduate classes- either up to three courses at 400 level courses or one 300 level and up to two 400 level courses. **It is recommended that the Program of Study be completed by the end of a student's first year of their graduate studies.**

CHAPTER 4 – COURSES, CREDITS, AND GRADING

4.1 Registration for classes

Registration for classes must be done as soon as possible. Consult with your major professor regarding the courses you want to take for your first semester. Information on course offerings can be found on the online Schedule of Classes (http://classes.iastate.edu/). Students then register using the Accessplus registration system which is available on the ISU homepage (www.iastate.edu). Incoming students are encouraged to register for classes before arriving on campus. As a new student, enter your social security number (no hyphens) and month and day of your birth (mm/dd). International students who do not yet have a social security number should use the number assigned in the admission packet from the Office of Admissions. A $20 late fee is assessed to students who wait until the first day of classes to register. The late fee goes up each of the following two weeks to a maximum of $100.

It is important to register for classes early in the registration period. Students who have accepted assistantship offers must be registered for classes for the appointment to be electronically processed by the University (for stipend and tuition scholarships). Space may be limited in classes and the sooner you register, the better chance you have at taking the classes you need.

4.3 Independent Study 490/590/690

Independent Study 490/590/690 will not have reference numbers listed in the Schedule of Classes. Students will see a message to 'see department'. Students will obtain section and reference information after submitting an Independent Study Approval Form to their home department's Graduate Programs office. Please note that the 490/590/690 credits may not be counted toward the core requirements of the Master of Engineering degree.

Once the student has submitted their form, the student will receive an email from the Graduate Program office with the course section and reference number. The 690 level courses are for advanced independent studies and should be indicated by the problem supervisor. Students should identify the specific course of 490/590/690 based on the area of focus for the independent study.

4.5 Engineering Internship 697

Graduate students may go on internships or co-operative education jobs (also called Curricular Practical Training or CPT) during the summer of any other semester during their degree program. This is generally done after consulting with the major professor.

Students should review the process for internships and co-ops for their specific home department.

4.6 Transfer Credits

At the discretion of the POSC, and with the approval of the program and the Graduate College, graduate credits earned as a graduate student at another institution or through a distance education program offered by another institution may be transferred if the grade was B or better. Such courses must have been acceptable toward an advanced degree at that institution and must have been taught by individuals having graduate faculty status at that institution. If a student wishes to transfer credits from graduate courses taken at or through another university as an undergraduate student, it is that student's responsibility to provide verification by letter from that institution that those graduate courses were not used to satisfy undergraduate requirements for a degree. (Grades from courses taken at another institution will **not** be included in ISU grade calculations, nor will the grades display on an ISU transcript.)

A transcript must accompany the POSC in order to transfer credits. The POSC may ask for other materials, such as a course outline or accreditation of the institution, to evaluate the course. Transfer courses not completed when the POSC is submitted must be completed before the term in which the student graduates. A transcript must then be submitted for review and final approval.

Research credits earned at another institution are generally not transferred. In rare circumstances, the transfer of S or P marks may be accepted for research credits only. It is the responsibility of the POSC to obtain a letter from the responsible faculty member at the other institution stating that research credits recommended for transfer with S or P marks are considered to be worthy of a B grade or better.

For all master's programs at Iowa State, at least 22 graduate credits must be earned at Iowa State. For all Ph.D. programs at Iowa State, at least 36 graduate credits must be earned at Iowa State.

The requirements of each degree must be met separately. If you'd like to include courses taken during pursuit of another degree, they must be courses that were in addition to the requirements of that degree.

4.7 Adding and Dropping Courses

After initial registration, adjustments to a student's schedule (e.g. course adds and drops, section changes and credit changes) can be made using AccessPlus until the end of the first week of classes. After the first week, all changes must be submitted on a Request for Schedule Change or Restriction Waiver form (better known as an Add/Drop Slip), which is available in the ME Grad Programs Office.

CHAPTER 5 – EXPECTATIONS

5.1 Professional Ethics and Academic Integrity

Graduate students are expected to comply with the Faculty Statement on Professional Ethics (see Faculty Handbook, Section 7.2).It is imperative that every student understands the ethical standards of engineering science and conduct his or her scholarly activities accordingly. Scientists and engineers, who commit unethical acts, whether from carelessness, ignorance, or malice, quickly lose the respect of the scientific community. Scientific misconduct includes such activities as:

- Falsification of data, ranging from fabrication to deceptively selective reporting, including the purposeful omission of conflicting data with the intent to falsify results
- Plagiarism: representation of another's work as one's own
- Misappropriate of the ideas of others: unauthorized use of privileged information
- Misappropriation of funds or resources for personal gain
- Falsification of one's credentials

In addition to scientific misconduct, graduate students are held accountable to the academic dishonesty policy. Academic dishonesty occurs when a student uses or attempts to use unauthorized information in the taking of an exam; or submits as his or her own work themes, reports, drawings, laboratory notes, or other products prepared by another person; or knowingly assists another student in such acts. Such behavior is abhorrent to the university, and students found guilty of academic dishonesty face suspension, conduct probation, or written reprimand. Instances of academic dishonesty ultimately affect all students and the entire university community by degrading the value of diplomas when some are obtained dishonestly and by lowering the grades of students working honestly. Examples of specific acts of academic dishonesty include, but are not limited to the following:

- Obtaining Unauthorized Information. Information is obtained dishonestly, for example, by copying graded homework assignments from another student, by working with another student on a take-home test or homework when not specifically permitted to do so by the instructor, by looking at one's notes or other written work during an examination when not specifically permitted to do so.
- Tendering of Information. Students may not give or sell their work to another person who plans to submit it as his or her own. This includes giving their work to another student to be copied, giving someone answers to exam questions during an exam, taking an exam and discussing its contents with students who will be taking the same exam, or giving or selling a term paper to another student.
- Misrepresentation. Students misrepresent their work by handing in the work of someone else. The following are examples: purchasing a paper from a term paper service; reproducing another person's paper (even with modifications) and submitting it as their own; having another student do their computer program; or having someone else take their exam.
- Bribery. Offering money or any item or service to a faculty member or any other person to gain academic advantage for oneself or for another is dishonest.
- Plagiarism. Unacknowledged use of information, ideas, or phrasing of other writers is an offense comparable with theft and fraud, and it is so recognized by the copyright and patent laws. Literary offenses of this kind are known as plagiarism.

At ISU, these acts are taken very seriously and constitute "academic misconduct". Individuals found guilty of academic misconduct may suffer a variety of penalties up to and including expulsion from the university. Academic dishonesty is considered a violation of the behavior expected of a student in an academic setting as well as a student conduct violation. A student found guilty of academic dishonesty is therefore subject to appropriate academic penalty, to be determined by the instructor of the course, as well as to penalty under the university student conduct regulations.

If a graduate student is accused of academic dishonesty relating to conduct of a sponsored research project, the matter will be handled in accordance with the university's "Policy on Academic Misconduct" (see Faculty Handbook, Section 7.2.2.3). In issues regarding conduct of research, graduate students are held to the same standards as faculty. Otherwise, the matter will be handled in accordance with the processes under the "Academic Life" section of the ISU Catalog.

If a student is aware of a potentially unethical situation, he or she should seek the advice of a trusted professor. Students may also contact the Director of Graduate Education (DOGE). All such discussions with the DOGE are considered and treated as confidential. It is very important to protect the rights of the individual whose actions are questioned. Frivolous accusations of misconduct and vicious spreading of rumors are just as unethical as fabrication of data or plagiarism.

5.2 General Expectations as a Graduate Student

You are responsible for developing your educational program to best meet your career and educational goals. Many of us are here to help you in this process, but we expect you to take the lead in your education. We expect that you will:

- work independently and responsibly in your area of research and show initiative
- ensure expectations between you and your major professor are clear through constant and clear communication
- broaden and enrich your education by attending talks and seminars in the department and on campus
- be aware of degree and assistantship requirements and deadlines and file paperwork in a timely manner
- represent yourself and the program with highest standards of integrity, ethics and professionalism

5.3 Learning Goals

Students in this program are expected to:

1. Demonstrate a broad knowledge in the field of Energy Systems Engineering.
2. Develop and demonstrate through their coursework a deep understanding and expertise in one or more areas of Energy Systems Engineering.
3. Discuss and apply an understanding of the current literature in Energy Systems Engineering and related disciplines
4. Understand and be able to identify their post-graduation career options: industrial, entrepreneurial and academic.
5. Demonstrate a commitment to the thoughtful consideration of fundamental principles of ethical professional conduct

CHAPTER 6 - COMPLETION OF PROGRAM

6.1 Application for Graduation

Application for graduation should be made by the end of the third week of the semester in which the student expects to receive the degree. To apply for graduation, the student is required to log into their AccessPlus account and submit the electronic Application for Graduation form. Before submitting this form, a student must have submitted the “Program of Study” form and had it approved by the Graduate College. The student must also have been fully-admitted to a program and met the Graduate English requirement (for nonnative English speakers). Graduation will be delayed if the “Application for Graduation” form filing deadline is not met. If it becomes apparent that a student cannot graduate during the indicated term, he/she should withdraw the application through AccessPlus. The student must then submit a new application for the next planned term of graduation.

6.2 Coursework Only Final Check

The Coursework Only Final Check, or Graduation Check, is specific for students in coursework only programs, including the Master of Engineering degree students. It should be submitted through the graduate college website within the first three weeks of the semester you intend to graduate.

6.3 Employment

Prior to graduation and departure, most students will be seeking employment. Employer representatives visit campus all during the year, but the prime interviewing season begins at the end of September and

continues into January and February. Students should visit the Engineering Career Services Office for further information.

Many companies offer interview trips to prospective employees. Students should check with their major professor and supervisor (if a teaching assistant) before going on interview trips.

CHAPTER 7 – RESOURCES

7.1 Campus Contacts

Graduate College Student Handbook – http://www.grad-college.iastate.edu/publications/gchandbook/.
Graduate and Professional Student Senate – http://www.grad-college.iastate.edu/gpss/
University Catalog – http://catalog.iastate.edu/
Schedule of Classes - https://classes.iastate.edu/
Center for Excellence in Learning and Teaching (CELT) – http://www.celt.iastate.edu
Graduate College Career Services
College of Engineering Career Services
Center for Communication Excellence (CCE)
Ombuds Office - http://www.ombuds.iastate.edu/
Distance Education Resources – http://www.distance.iastate.edu/
International Students and Scholars Office – http://www.isso.iastate.edu/
Oral English Certification Test (OECT) – http://www.grad-college.iastate.edu/speakteach/
English Placement Test – http://apling.public.iastate.edu/engl101.html

7.2 ME Graduate Student Organization (MEGSO)

The ME Graduate Student Organization (MEGSO) was founded for the purpose of promoting interaction among the students of the department. The organization strives to create a friendly working atmosphere between students and faculty. MEGSO also promotes professional activities and interacts with faculty candidates.

Events during the year such as picnics, potluck dinners, bowling and field trips provide an excellent way for MEGSO members to interact in a social setting. MEGSO members show prospective graduate students around the campus and city during visits. Enrollment is currently limited to ME graduate students, although members are encouraged to bring guests to the functions. To participate in MEGSO, simply watch for an announcement as to when and where the meeting will be held. MEGSO also hosts a mandatory learning community for all new first year ME students.

7.3 Mediation of Student Disputes and Grievances

When graduate students become involved in disputes with their mentors that cannot be resolved by direct communication, the Graduate Programs Office will serve as informal or formal mediator depending on the particular circumstances. Students should feel free to contact the DOGE should such disputes. All such conversations are strictly confidential and the DOGE will work with the student to help resolve the dispute. Several formal avenues of appeal are available to graduate students to handle grievances concerning grades and instruction and for grievances related to scholarly and professional competence. All procedures start at the department or program level and lead through a series of steps to higher appeal channels. All such grievance procedures must be initiated within 3 weeks after end of semester during which the alleged grievance occurred. The Mechanical Engineering's grievance procedure is outlined below. Information for appeals at higher levels can be found in the Graduate College Handbook.

7.3.1 Grievances about Grades and Instruction

Grievances arising out of classroom or other academic situations should be resolved, if at all possible, with the individual instructor involved. If resolution cannot be reached, the student should discuss the grievance with the instructor's department executive officer (chair) and submit it in writing to him or her. The department executive officer will discuss the grievance with the instructor involved and/or refer it to a department grievance committee. The department executive officer should respond in writing to the student within five class days.

7.3.2 Grievances Related to Scholarly and Professional Competence

Judgment of professional competence as demonstrated in such matters as qualifying, preliminary and final oral examinations, and other clearly stated program requirements concerning competence in the field of study is the responsibility of the academic program and Program of Study and Committee (POSC).

If a student feels that his or her scholarly or professional competence has not been evaluated fairly, he/she should first discuss the complaint with the person or persons most directly involved in the matter: a faculty member, major professor, POSC, director of graduate education (DOGE), or department chair. If these discussions are unsuccessful and further adjudication is desired, the student may request (in writing) that the grievance be handled by the department grievance committee.

7.3.3 Department grievance committee

The DOGE shall appoint a grievance committee to handle student grievances. The committee will comprise of equal representation from faculty and graduate students. The DOGE will serve as a non-voting member of the committee. The committee shall review the grievance and present its recommendation in writing to the DOGE within one week after all necessary information is provided to them. The DOGE will then provide a written response to the student.

Appendix A: Approved Courses for Math/Stats Requirement (Energy Systems)

<table>
<tr><th colspan="2">All Math and Statistics Courses 400 and higher labeled non-major graduate credit</th></tr>
<tr><td colspan="2">Popular courses include:
STAT 587*: Statistical Method for Researchers
STAT 495*: Applied Statistics for Industry</td></tr>
<tr><th colspan="2">Optimization (linear, nonlinear, and integer programming; global optimization methods)</th></tr>
<tr><td>IE 510*: Network Analysis
IE 534*: Linear Programming
IE 631: Nonlinear Programming
IE 632: Integer Programming</td><td>Econ 500/600: Quantitative Methods in Economic Analysis I/II
Econ 509: Applied Numerical Methods in Economics</td></tr>
<tr><th colspan="2">Modeling and Simulation (physical modeling through differential equations and their solution, computer visualization)</th></tr>
<tr><td>EM 425: Introduction to Finite Element Methods
EM 525: Finite Element Analysis
EM 526: Boundary Element Methods in Engineering
Phys 480/481: Quantum Mechanics I/II
Phys 531: Statistical Mechanics
Phys 564: Advanced Classical Mechanics
Phys 591/592: Quantum Physics I/II
ME 546*/547: Computational Fluid Dynamics and Heat Transfer I/II</td><td>ME 557*: Computer Graphics and Geometric Modeling (Note: This course can be counted on a student’s POSC if they were admitted prior to Fall 2013.)
ComS 477/577: Problem Solving Techniques for Applied Computer Science
AerE 647: Advanced High Speed Computational Fluid Dynamics
AerE 572: Turbulence
ChE 545*: Analytical and Numerical Methods</td></tr>
<tr><th colspan="2">Mathematical Theory</th></tr>
<tr><td>Linear & abstract algebra, real & functional analysis
EM 510: Continuum Mechanics
EE 570*: Systems Engineering Analysis and Design
EE 674: Advanced Topics in Systems Engineering
Phys 534: Symmetry and Group Theory in Physics</td><td>Probability and Statistics (outside of statistics department)
IE 513*: Analysis of Stochastic Systems
IE 533*: Reliability
Econ 500: Quantitative Methods in Economic Analysis I
Econ 509: Applied Numerical Methods in Economics
Econ 571: Intermediate Econometrics
Econ 671/672: Econometrics I/II</td></tr>
</table>

Appendix B: Approved Professional Development Courses

- ConE 380*: Engineering Law
- Econ 355: International Trade and Finance
- Fin 501*: Financial Valuation and Corporate Financial Decisions
- HCI 594X*: Organizational Application of Collaborative Technology
- HG ED 561: College Teaching
- IE 563*: Engineering Management Theory
- IE 570*: Systems Engineering and Project Management
- ME 584*: Technology, Globalization and Culture
- MGMT 503*: Professional Responsibility in Business and Society
- MGMT 570: Managing Employee Attitudes and Behaviors
- MGMT 571: Seminar in Personnel and Human Resources Management
- MGMT 583*: Strategic Management of Innovation
- MKT 501*: Marketing
- SCM 502: Supply Chain Management
- SCM 524*: Strategic Process Analysis and Improvement
- Any foreign language courses labeled “non-major graduate credit” (prerequisites may be needed which will not count toward this requirement
- Other courses, as approved by the POSC

*indicates available online

Appendix C: Approved Electives for Master of Engineering

		Focus Area					
Course	Course Title	B	W	M	P	E	T
ABE 363	Agri-Industrial Applications of Electric Power and Electronics			X			
ABE 413	Fluid Power Engineering			X			X
ABE 572	Design of Environmental Modification Systems for Animal Housing					X	
ABE 580	Engineering Analysis of Biological Systems	X					
*AerE 381	Introduction to Wind Energy		X				
AerE 481	Advanced Wind Energy: Technology and Design		X				
*AerE 546	Computational Fluid Dynamics and Heat Transfer I		X			X	X
*AerE 547	Computational Fluid Dynamics and Heat Transfer II		X			X	X
AerE 570	Wind Engineering		X				
AE 363	Agri-Industrial Applications of Electric Power and Electronics			X			
AE 568	Pretreatment of Biomass	X					
BSE 480	Engineering Analysis of Biological Systems	X					
*BRT 501	Fundamentals of Biorenewable Resources	X					
BRT 515	Biorenewables Law and Policy	X					
BRT 516	International Biorenewables Law and Policy	X					
*BRT 535	Thermochemical Processing of Biomass	X					
*ChE 357	Transport Phenomenon II						X
ChE 358	Separations	X					X
ChE 381	Chemical Engineering Thermodynamics						X
ChE 382	Chemical Reaction Engineering						X
ChE 515	Biochemical Engineering	X					
*ChE 554	Integrated Transport Phenomenon	X					X
ChE 583	Advanced Thermodynamics	X			X	X	X
ChE 587	Advanced Chemical Reactor Design						X
ChE 632	Multiphase Flow						X
ChE 652	Advanced Transport						X
CE 540	Bioprocessing and Bioproducts	X					
CE 594S	Building Energy Modeling					X	
ConE 353	Electrical Systems in Buildings					X	
*ConE 354X	Building Energy Systems					X	

EE 448	Introduction to AC Circuits and Motors				X		
*EE 455	Introduction to Energy Distribution Systems				X		
*EE 456	Power Systems Analysis I				X		
*EE 457	Power Systems Analysis II				X		
*EE 458	Economic Systems for Electric Power Planning				X		
*EE 552	Energy System Planning				X		
*EE 553	Steady State Analysis				X		
*EE 554	Power System Dynamics				X		
EE 555	Advanced Energy Distribution Systems				X		
*EE 556	Power Electronic Systems				X		
*EE 559	Electromechanical Wind Energy Conversion and Grid Integration		X		X		
*EE 653	Advanced Topics in Electric Power Systems Engineering				X		
IE 543X	Wind Energy Manufacturing		X				
*ME 332	Engineering Thermodynamics II				X	X	X
*ME 413	Fluid Power Engineering				X		X
*ME 433	Alternative Energy Consumption	X	X	X	X	X	X
ME 436	Heat Transfer					X	X
ME 437	Introduction to Combustion Engineering				X		X
ME 441	Fundamentals of Heating, Ventilating, and Air Conditioning					X	
ME 442	Heating and Air Conditioning Design					X	
ME 444	Elements and Performance of Power Plants			X	X		X
ME 449	Internal Combustion Engine Design				X		X
*ME 530	Advanced Thermodynamics				X	X	X
*ME 532	Compressible Fluid Flow				X		X
*ME 535	Thermochemical Processing of Biomass	X					
*ME 536	Advanced Heat Transfer					X	X
*ME 538	Advanced Fluid Flow						X
*ME 539	Nanoscale Heat Transfer					X	X
*ME 542	Advanced Combustion						X
ME 545	Thermal Systems Design	X	X	X	X	X	X
*ME 546	Computational Fluid Mechanics and Heat Transfer I		X			X	X
*ME 547	Computational Fluid Mechanics and Heat Transfer II		X			X	X
*ME 632	Multiphase Flow						X
*ME 637	Convection Heat Transfer					X	X

ME 638	Radiation Heat Transfer	X	X	X
MatE 311	Thermodynamics in Materials Engineering			X
MSE 520	Thermodynamics and Kinetics of Multicomponent Materials			X
*NucE 401	Nuclear Radiation Theory and Engineering	X		
*NucE 421	Nuclear Criticality Safety	X		
*NucE 441	Probabilistic Risk Analysis	X		
NucE 461	Radiation Detection, Measurement, and Simulation	X		

Appendix D: Approved Electives for Certificate

- AerE 381 Introduction to Wind Energy
- AerE 546 Computational Fluid Dynamics and Heat Transfer I
- AerE 547 Computational Fluid Dynamics and Heat Transfer II
- BRT 501 Fundamentals of Biorenewable Resources
- BRT 535 Thermochemical Processing of Biomass
- ChE 357 Transport Phenomenon II
- ChE 554 Integrated Transport Phenomenon
- ConE 354 Building Energy Systems
- EE 455 Introduction to Energy Distribution
- EE 456 Power System Analysis I
- EE 457 Power System Analysis II
- EE 458 Economic Systems for Electric Power Planning
- EE 553 Steady State Analysis
- EE 554 Power System Dynamics
- EE 556 Power Electronic Systems
- EE 653 Advanced Topics in Electric Power Systems Engineering
- ME 332 Engineering Thermodynamics II
- ME 433 Alternative Energy Conversion
- ME 530 Advanced Thermodynamics
- ME 540 Solar Energy Systems
- ME 542 Advanced Combustion
- ME 546 Computational Fluid Mechanics and Heat Transfer I
- ME 547 Computational Fluid Mechanics and Heat Transfer II
- ME 637 Convection Heat Transfer
- NucE 401 Nuclear Radiation Theory and Engineering
- NucE 430 Nuclear Engineering and Society