

**Master of Engineering in Energy Systems Engineering
College of Engineering, Iowa State University**

Program requirements*

Degree requirement	Credits	Description
Required courses (2)	6	<ul style="list-style-type: none"> • 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 (1)	3	Any 400-level or higher Math or Statistics class or a class with significant math content from an approved list.
Professional Development (1)	3	Area of interest that meets the individual educational objectives of the student for professional development from an approved list.
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)
Free elective	3	Any class from the above categories.

* per the graduate school requirements, up to three (3) courses at the 400 level will be permitted, or a POS may include one (1) 300-level class and two (2) 400-level classes; all other classes must be at the graduate level (500 and above).

Prerequisites for prospective students.

1. 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.
2. 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).

Language requirements.

None

Courses and seminars presently available for credit toward the program.**Math/Statistics requirement**

Three (3) credits of any 400-level or higher Math or Statistics will count towards this requirement. Non-Math/Stat courses with strong math or statistics content that are approved by the Master of Engineering – Energy Systems Engineering Steering Committee may also count towards meeting this requirement.

Approved courses for Math/Stat requirement (*=offered online)

- All Statistics courses 400-level and higher. Popular courses are:
 - *STAT 401: Statistical Method for Researchers
 - *STAT 495: Applied Statistics for Industry
- All Math courses 400-level and higher.
- Optimization (linear, nonlinear, and integer programming; global optimization methods)
 - *IE 510: Network Analysis
 - *IE 534: Linear Programming
 - IE 631: Nonlinear Programming
 - IE 632: Integer Programming
 - Econ 500/600: Quantitative Methods in Economic Analysis I/II
 - Econ 509: Applied Numerical Methods in Economics
- Modeling and Simulation (physical modeling through differential equations and their solution, computer visualization)
 - 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
 - *ME 557: Computer Graphics and Geometric Modeling
 - 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
- Linear and abstract algebra, real and 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
- 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: Introductory Econometrics
 - Econ 671/672: Econometrics I/II

Professional Development requirement

Three (3) credits in an area of interest that meets the individual educational objectives of the student for professional development that is approved by the Master of Engineering – Energy Systems Engineering Steering Committee

Approved courses for Professional Development requirement (*=offered online)

- *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 560: Engineering Risk Analysis
- *IE 563: Engineering Management Theory
- *IE 570: Systems Engineering and Project Management
- *ME 584: Technology, Globalization and Culture
- 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
- *MGMT 503 Professional Responsibility in Business and Society
- SCM 502: Supply Chain Management
- *SCM 524: Strategic Process Analysis and Improvement
- Any foreign language course 300-level or higher (prerequisites may be needed which will not count towards the requirement).
- Other courses, as approved by the POS committee

Elective Engineering Courses

Fifteen (15) graduate credits in energy systems engineering from an approved list. These courses are determined by the student and academic advisor to fit the needs of the individual student's program. 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.

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.

Students must take at least nine (9) credits in a single focus area: biorenewables (B), wind (W), nuclear (N), power generation and distribution (P), building energy and energy efficiency (E), or thermal science (T).

Approved courses for Engineering Electives requirement (Many of these courses are offered online):

Per the graduate school requirements, up to three (3) courses at the 400 level will be permitted, or a POS may include one (1) 300-level class and two (2) 400-level classes; all other classes must be at the graduate level (500 and above).

Course	Course Title	Focus Area					
		B	W	N	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				
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 587	Advanced Chemical Reactor Design						X
ChE 583	Advanced Thermodynamics	X			X	X	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 354	Building Energy Systems					X	
EE 448	Introduction to AC Circuits and Motors				X		
EE 455	Introduction to Energy Distribution Systems				X		
EE 456	Power System Analysis I				X		
EE 457	Power System 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 543	Wind Energy Manufacturing		X				

Approved courses for Engineering Electives requirement (Many of these courses are offered online) Continued from previous page:

Per the graduate school requirements, up to three (3) courses at the 400 level will be permitted, or a POS may include one (1) 300-level class and two (2) 400-level classes; all other classes must be at the graduate level (500 and above).

Course	Course Title	Focus Area					
		B	W	N	P	E	T
ME 332	Engineering Thermodynamics II				X	X	X
ME 413	Fluid Power Engineering				X		X
ME 433	Alternative Energy Conversion	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 448	Fluid Dynamics of Turbomachinery				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		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			