

# ENGINEERING THERMAL ENERGY SYSTEMS, CERTIFICATE

Efficient use of thermal energy is an increasingly popular area of interest for UW–Madison engineering students and employers. The objective of the certificate in engineering thermal energy systems program is to provide students in the College of Engineering with an organized set of courses that will improve their capacity to analyze and design innovative thermal energy systems. These systems include, but are not limited to, energy conversion systems and their fuels, refrigeration, combustion, and solar energy. Thermal energy systems either employ thermal energy directly or convert thermal energy to other energy forms.

## HOW TO GET IN

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Students who wish to apply for admission into this certificate program will need to complete a major/certificate declaration form obtained from the student services office. Once approved by the student services office and the student's faculty advisor, the form will be forwarded to the Dean's Office to be added to the student record. The student services office will, in conjunction with the student's advisor and curriculum committee chair, assist the student in selecting appropriate courses that fulfill certificate requirements. If a Special student does not have a home department in the College of Engineering, the Department of Mechanical Engineering will advise and sponsor the student in this program. To receive the certificate, the applicant must achieve a GPA of 3.0 or higher in the proposed courses listed on the completed form.

Submit the completed Declaration of Intent Form (<https://go.wisc.edu/u9x8g2/>) to student services.

## REQUIREMENTS

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The certificate, geared toward UW–Madison undergraduate students, requires a total of 18 completed credits. Up to 9 of the credits can be thermal-energy-related courses that are required in the student's undergraduate major. The additional 9 credits must be selected from an assortment of approved elective courses in the College of Engineering.

### COURSES

Courses not on this list must be specifically approved by the certificate curriculum committee.

| Code                          | Title  | Credits |
|-------------------------------|--|---------|
| <b>Mechanical Engineering</b> |  |         |
| M E 460                       | Applied Thermal / Structural Finite Element Analysis | 3       |
| M E 461                       | Thermal Systems Modeling                             | 3       |
| M E 469                       | Internal Combustion Engines                          | 3       |
| M E 471                       | Gas Turbine and Jet Propulsion                       | 3       |

|             |  |   |
|-------------|--|---|
| M E 472     | Energy, Sustainability, and Technology | 3 |
| M E/N E 520 | Two-Phase Flow and Heat Transfer       | 3 |
| M E 561     | Intermediate Thermodynamics            | 3 |
| M E 563     | Intermediate Fluid Dynamics            | 3 |
| M E 564     | Heat Transfer                          | 3 |
| M E/N E 565 | Power Plant Technology                 | 3 |
| M E/E P 566 | Cryogenics                             | 3 |
| M E/CBE 567 | Solar Energy Technology                | 3 |
| M E 569     | Applied Combustion                     | 3 |
| M E 572     | Intermediate Gas Dynamics              | 3 |
| M E 573     | Computational Fluid Dynamics           | 3 |

### Chemical and Biological Engineering

|             |  |   |
|-------------|--|---|
| CBE 320     | Introductory Transport Phenomena                     | 4 |
| CBE 430     | Chemical Kinetics and Reactor Design                 | 3 |
| CBE 440     | Chemical Engineering Materials                       | 3 |
| CBE/M E 567 | Solar Energy Technology                              | 3 |
| CBE 535     | Heterogeneous Catalysis: Principles and Applications | 3 |

### Civil and Environmental Engineering

|              |  |   |
|--------------|--|---|
| CIV ENGR 423 | Air Pollution Effects, Measurement and Control | 3 |
|--------------|--|---|

### Engineering Mechanics and Astronautics

|           |                   |   |
|-----------|-------------------|---|
| E M A 521 | Aerodynamics      | 3 |
| E M A 522 | Aerodynamics Lab  | 3 |
| E M A 524 | Rocket Propulsion | 3 |

### Nuclear Engineering

|             |                                    |   |
|-------------|------------------------------------|---|
| N E 411     | Nuclear Reactor Engineering        | 3 |
| N E/M E 520 | Two-Phase Flow and Heat Transfer   | 3 |
| N E 550     | Advanced Nuclear Power Engineering | 3 |
| N E/M E 565 | Power Plant Technology             | 3 |
| E P/M E 566 | Cryogenics                         | 3 |

### Biological Systems Engineering

|                  |   |   |
|------------------|---|---|
| BSE/ENVIR ST 367 | Renewable Energy Systems                                  | 3 |
| BSE 460          | Biorefining: Energy and Products from Renewable Resources | 3 |

### Materials Science and Engineering

|             |  |   |
|-------------|--|---|
| M S & E 463 | Materials for Elevated Temperature Service | 3 |
|-------------|--|---|

## CERTIFICATE COMPLETION REQUIREMENT

This undergraduate certificate must be completed concurrently with the student's undergraduate degree. Students cannot delay degree completion to complete the certificate.

## LEARNING OUTCOMES

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1. Follow a directed sequence of technical elective courses specializing in thermal energy systems.

2 Engineering Thermal Energy Systems, Certificate

2. Synthesize knowledge gained from a curriculum that focuses on applying fundamentals of engineering to the analysis of thermal energy systems.
3. Be prepared for the job market with a solid background in the energy field.