

Course Syllabus  
**Fundamentals of Thermodynamics**  
**ENG 200**

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## SECTION 1

### Course Introduction

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**Credit Hours:** This course is recommended for 3 US semester credits. The class consists of 37.5 classroom hours with an additional 10-12 hours spent outside the classroom, including excursions, visits to professional organizations, and activities.

**Prerequisite Courses:** General Physics, multivariable Calculus

**Course Introduction:**

From Rudolf Clausius to Max Planck, German researchers helped transform thermodynamics into the subject studied today.

In this course you will cover material related principally to classical thermodynamics and their applications. The content of this course will thus focus on thermodynamics terminology, evaluating properties of pure substances, conservation of mass and energy, the Carnot Cycle, the First Law of Thermodynamics, the Second Law of Thermodynamics, entropy, reversibility, and applications of thermodynamics in engineering systems.

In addition to the cognitive and knowledge skills listed above, students in this course will consider the contributions of Germans in science, mathematics, technology, and engineering through experiential learning components.

### Course Learning Outcomes

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At the end of this course students will be able to:

1. Identify basic principles of engineering thermodynamics.
2. Use thermodynamic principles in practice.
3. Understand thermodynamic terminology and analysis.
4. Communicate ideas in writing and graphically.

5. Gain confidence in their knowledge base and mental discipline for self-education.

## Assessment

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- A Achievement that is outstanding relative to the level necessary to meet course requirements.  
 B Achievement that is significantly above the level necessary to meet course requirements.  
 C Achievement that meets the course requirements in every respect.  
 D Achievement that is worthy of credit even though it fails to meet fully the course requirements.  
 P Achievement that is satisfactory, which is equivalent to a C- or better (achievement required for a P is at the discretion of the instructor but may be no lower than equivalent to a C-.)  
 NP Represents failure (or no credit) and signifies that the work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I (see also I).  
 I (Incomplete) - Assigned at the discretion of the instructor when, due to extraordinary circumstances, e.g., hospitalization, a student is prevented from completing the work of the course on time. Requires a written agreement between instructor and student.

### Grading Scale (Based on points)

|          |      |         |      |            |     |
|----------|------|---------|------|------------|-----|
| 95 – 100 | ⇒ A  | 77 – 79 | ⇒ C+ | 59 – Lower | ⇒ E |
| 90 – 94  | ⇒ A- | 74 – 76 | ⇒ C  |            |     |
| 87 – 89  | ⇒ B+ | 70 – 73 | ⇒ C- |            |     |
| 84 – 86  | ⇒ B  | 67 – 69 | ⇒ D+ |            |     |
| 80 – 83  | ⇒ B- | 60 – 66 | ⇒ D  |            |     |

### Distribution of Course Points

#### Attendance and participation 10%

Active participation in class discussions. Engagement in group activities and simulations. Contribution to discussions during experiential visits.

#### Chapter Quizzes 60%

Students will have a quiz after the end of each chapter.

#### Final Exam 30%

Students will have a final-term exam on the second half of the course.

## Academic Policies

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All program participants recognize and accept that the **CEPA ESC Strasbourg Academic Policies** apply to this course as well as to any other course offered through the European Study Center at Strasbourg. These policies, which govern

academic standards, expectations, and requirements for all CEPA ESC Strasbourg participants, are published on the **CEPA ESC Strasbourg website** and are also accessible at any time through the **Policies tab** in the CEPA mobile app. You are required to read and understand these policies as they form part of the binding academic framework for this program.

Please ensure you **review the full CEPA ESC Strasbourg Program Policies** document as soon as possible and inquire with CEPA support staff or your faculty if you have questions, requests or concerns.

### Course-Specific Applications and Clarifications

While all CEPA ESC Strasbourg Academic Policies apply uniformly across ESC programs, the instructor may provide additional course-specific details or clarifications regarding how certain policies are implemented in this course (for example, participation expectations, assignment formats, or submission procedures). Any such course-specific guidance is intended to supplement—not replace or contradict—the official CEPA ESC Strasbourg Academic Policies. In cases of discrepancy, the CEPA ESC Strasbourg Academic Policies take precedence.

## SECTION 2

### General

Homework assignments are recommended, not required, as they will not be turned in for grades. However, they are intended to help you understand the class material, and to stay on track in the course. Questions on the assignments will be addressed at the beginning of each class session, as well as during each week's Reading Day (week review and practice).

### Class Meets:

Weekly throughout the term, usually in five, 1 hour 30 minute sessions  
Detailed course schedule with hours and locations of classes is TBC.

### Class Schedule and Sequence of Instruction

| Class Session | Date    | Course Content                                                                                                                                                                        | Assignment                                      |
|---------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Week 1        | Class 1 | Introduction, Ch. 1 – Getting Started, Exploring System Concepts, Working with Units, Working with Force and Mass, Using Specific Volume, Volume, and Pressure, Exploring Temperature | Ch 1 – 1.10, 1.15, 1.30, 1.45, 1.52             |
|               | Class 2 | Ch. 2.1 Reviewing Mechanical Concepts of Energy, Ch. 2.2 Broadening Our Understanding of Work                                                                                         | Ch 2 – 2.6, 2.7, 2.11                           |
|               | Class 3 | Ch. 2.3 Broadening Our Understanding of Energy, Ch. 2.5 Energy Balance for Closed Systems                                                                                             | Ch 2 – 2.21, 2.25, 2.39, 2.47, 2.55, 2.59, 2.63 |

|        |          |                                                                                                                                                                                                          |                                          |
|--------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
|        | Class 4  | Ch. 2.6 Energy Analysis of Cycles, Ch. 2.7 Energy Storage                                                                                                                                                | Ch 2 – 2.75, 2.79, 2.81, 2.91            |
|        | Class 5  | Reading Day - Week review and practice                                                                                                                                                                   |                                          |
| Week 2 | Class 6  | Review of Ch 2, <b>Chapters 1 - 2 Quiz</b>                                                                                                                                                               |                                          |
|        | Class 7  | Ch. 3.2 p-v-T Relation, Ch. 3.3 Studying Phase Change, Ch. 3.4 Retrieving Thermodynamic Properties                                                                                                       | Ch 3 – 3.5, 3.13, 3.15, 3.23, 3.39, 3.43 |
|        | Class 8  | Ch. 3.6 Evaluating Specific Internal Energy and Enthalpy, Ch. 3.9 Introducing Specific Heats $c_v$ and $c_p$ , Ch. 3.10 Evaluating Properties of Liquids and Solids                                      | Ch 3 – 3.47, 3.55, 3.71, 3.79, 3.83      |
|        | Class 9  | Ch. 3.12 Introducing the Ideal Gas Model, Ch 3.13 Internal Energy, Enthalpy, and Specific Heats of Ideal Gases                                                                                           | Ch 3 – 3.101, 3.107, 3.111, 3.129        |
|        | Class 10 | Reading Day - Week review and practice                                                                                                                                                                   | Study for Week 2 Quiz                    |
| Week 3 | Class 11 | Review of Ch 3, <b>Chapter 3 Quiz</b>                                                                                                                                                                    |                                          |
|        | Class 12 | Ch 4.1 Conservation of Mass for a Control Volume, Ch 4.2 Forms of the Mass Rate Balance, Ch 4.3 Applications of the Mass Rate Balance                                                                    | Ch 4 – 4.3, 4.9, 4.19                    |
|        | Class 13 | Ch 4.8 Compressors and Pumps, Ch 4.9 Heat Exchangers                                                                                                                                                     | Ch 4 – 4.51, 4.67, 4.73                  |
|        | Class 14 | Ch. 4.10 Throttling Devices, Ch 4.11 System Integration, Ch 4.12 Transient Analysis                                                                                                                      | Ch 4 – 4.101, 4.105, 4.111               |
|        | Class 15 | Reading Day - Week review and practice                                                                                                                                                                   | Study for Week 3 Quiz                    |
| Week 4 | Class 16 | Review of Chapter 4, <b>Chapter 4 Quiz</b>                                                                                                                                                               |                                          |
|        | Class 17 | Ch 5.1 Introducing the Second Law, Ch 5.2 Statements of the Second Law, Ch 5.3 Irreversible and Reversible Processes                                                                                     | Ch 5 – 5.3, 5.5, 5.19                    |
|        | Class 18 | Ch 5.4 Interpreting the Kelvin-Planck Statement, Ch 5.7 Second Law Aspects of Refrigeration and Heat Pump Cycles Interacting with Two Reservoirs, Ch 5.8 The Kelvin and International Temperature Scales | Ch 5 - 5.29, 5.31, 5.35, 5.43, 5.51      |
|        | Class 19 | Ch 5.9 Maximum Performance Measures for Cycles Operating Between Two Reservoirs, Ch 5.20 Carnot Cycle, Ch 5.11 Clausius Inequality                                                                       | Ch 5 – Ch 5.77, 5.83, 5.89               |
|        | Class 20 | Reading Day - Week review and practice                                                                                                                                                                   | Study for Week 4 Quiz                    |

|        |          |                                                                                                                                                                                                            |                                 |
|--------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Week 5 | Class 21 | Review of Chapter 5, <b>Chapter 5 Quiz</b>                                                                                                                                                                 |                                 |
|        | Class 22 | Ch 6.1 Entropy-A System Property, Ch 6.2 Retrieving Entropy Data, Ch 6.3 Introducing the T dS Equations                                                                                                    | Ch 6 - 6.7, 6.11, 6.17          |
|        | Class 23 | Ch 6.4 Entropy Change of an Incompressible Substance, Ch 6.5 Entropy Change of an Ideal Gas, Ch 6.6 Entropy Change in Internally Reversible Processes of Closed Systems, Ch 6.7 Entropy for Closed Systems | Ch 6 – 6.21, 6.35, 6.49, 6.57   |
|        | Class 24 | Ch 6.9 Entropy Rate Balance of Control Volumes, Ch 6.10 Rate Balances for Control Volumes at Steady State, Ch 6.12 Isentropic Efficiencies of Turbines, Nozzles, Compressors, and Pumps                    | Ch 6 – 6.81, 6.87, 6.101, 6.119 |
|        | Class 25 | Reading Day - Week review and practice                                                                                                                                                                     | Review Ch. 1-6                  |
| Week 6 | Class 26 | Applications (Ch 8 – 10)                                                                                                                                                                                   | Review Ch. 1-6                  |
|        | Class 27 | Review Ch 1-3                                                                                                                                                                                              | Review Ch. 1-6                  |
|        | Class 28 | Review Ch 4-6                                                                                                                                                                                              | Review Ch. 1-6                  |
|        | Class 29 | Reading Day - Week review and practice                                                                                                                                                                     | Review Ch. 1-6                  |
|        | Class 30 | <b>Final Exam</b>                                                                                                                                                                                          |                                 |

## Instructional Materials

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(These may be available through your on campus electronic library. Relevant chapters will be provided for students who do not have access to the electronic version.)

1. Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey. Fundamentals of Engineering Thermodynamics, 9<sup>th</sup> Edition, 2018.