

MEAM 353, THERMODYNAMICS II

SYLLABUS

Text: " Fundamentals of Thermodynamics" by Sonntag, Borgnakke and Van Wylen, 6th edition.

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COURSE CONTENT

The content of the course and the approximate class time devoted to each topic is outlined below.

<u>Chapter</u>	<u>Topics</u>	<u>Class Periods</u>
	Review of ME 351	5
11	Selected thermodynamic cycles.	8
12	Non-reacting thermodynamic mixtures, properties of such mixtures, moist air calculations, applications of such mixtures.	7
13	Equations of state, Thermodynamic relationships, generalized Thermodynamic properties, applications of such relationships and properties.	8
14	Combustion process, energy analysis of reacting mixtures, second law analysis.	8
15	Chemical equilibrium, equilibrium composition of mixtures.	8

COURSE OUTCOMES

1. Students will be exposed to selected equations of state used to model the behavior of real gases. (1a, 1b)
2. Students will understand the concept of generalized thermodynamic relationships and be able to use these relationships to model the behavior of real substance, especially at high pressures. (1a, 1b, 1c, 2e)

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3. Students will understand the thermodynamics of non-reacting mixtures of ideal gases and be able to apply these concepts to engineering problems such as the psychometrics of air-water vapor mixtures. (1a, 1b)
4. Students will understand the concepts of reacting mixtures (example is the combustion process) and will be able to evaluate the energy transfer for such processes. (1a, 1b, 1c, 2e)
5. Students will understand the concepts of chemical equilibrium and equilibrium of mixtures. They will also be able to apply these concepts to typical engineering problems. (1a, 1b, 2e)
6. Students will apply the thermodynamic concepts to evaluate the performance of selected power and refrigeration cycles. (1a, 1b, 1c, 2e)

Items in parenthesis refer to the affected Program outcomes (see attachment).

COURSE GRADES

The grades for the course will be determined as follows:

Exams	50%
Final exam	30%
Homework and design project	20%

There will be an exam problem given about every two weeks. **Individual makeup exams will be given for missed exams at the discretion of the instructor and only for an excused absence.**

The final exam will be given at the time designated by the University final test schedule. All students must take the final exam at this time.

Homework assignments will be given daily and are considered due the following class period. Homework problems may occasionally be collected at the **beginning of class** and may be graded. **No late papers will be accepted.** Homework must be in acceptable engineering form including given and find statements and labeled drawings of the system being considered or it will not be graded.

Final course grades will assigned according to the following scale.

- A 90% or greater
- B 80% to less than 90%
- C 70% to less than 80%
- D 60% to less than 70%
- F less than 60%

STUDENTS WITH SPECIAL NEEDS

Students who have any disability that might affect their performance in this class are encouraged to speak with the instructor early in the semester.

All work in this course must be completed in a manner consistent with NDSU University Senate Policy, Section 335: Code of Academic Responsibility and Conduct
(<http://www.ndsu.nodak.edu/policy.335.htm>)

Department of Mechanical Engineering and Applied Mechanics, North Dakota State University

Mission

To educate undergraduate and graduate students in the fundamentals of the discipline, and prepare graduates (BS, MS, or PhD) to effectively function in society in the field of their choice while also having the learning skills to adapt to evolving personal and professional goals.

Program Educational Objectives & Outcomes

Objective 1: To provide our students with a fundamental understanding of the engineering sciences in the areas relevant to the field of Mechanical Engineering .

- Outcomes:*
- a) Graduates must have the ability to apply knowledge of mathematics and science to solve engineering problems.
 - b) Graduates must have the ability to identify, formulate, and solve fundamental engineering problems.
 - c) Graduates must have the ability to identify a suitable model for a physical system, and apply principles of mechanics, thermodynamics, fluid mechanics, and materials to obtain a solution that satisfies the constraints.

Objective 2: To provide our students with the ability to develop the skills and apply the knowledge and tools relevant to the field of Mechanical Engineering.

- Outcomes:*
- a) Graduates must have the ability to design and conduct experiments as well as to analyze and interpret data.
 - b) Graduates must have the ability to design a system, component, or process to meet desired needs.
 - c) Graduates must recognize the need for, and possess an ability to engage in, life-long learning.

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- d) Graduates must have the ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
- e) Graduates must be able to analyze a physical system, and create and validate models based on engineering and mathematical principles that correctly represent such systems and reflect current industry practices.

Objective 3: To provide our students with the team-working skills and communications skills required for effectively interacting with people of varying technical background.

- Outcomes:*
- a) Graduates must have the ability to function on multidisciplinary teams.
 - b) Graduates must have the ability to communicate effectively.

Objective 4: To provide our students with a broad view of the context in which their designs will be implemented and the corresponding impact on society.

- Outcomes:*
- a) Graduates must have an understanding of professional and ethical responsibility.
 - b) Graduates must possess the broad education necessary to understand the impact of engineering solutions in a global/societal context.
 - c) Graduates must possess knowledge of contemporary issues.