

科目ナンバリング		U-LAS12 10010 LE57									
授業科目名 <英訳>		Thermodynamics Thermodynamics				担当者所属 職名・氏名		工学研究科 准教授 KHAYYER ABBAS			
群	自然科学科目群			分野(分類)	物理学(基礎)			使用言語	英語		
旧群	B群	単位数	2単位	週コマ数	1コマ	授業形態	講義（対面授業科目）				
開講年度・ 開講期	2024・後期		曜時限	金2		配当学年	主として1回生	対象学生	理系向		

### 【授業の概要・目的】

This course provides an introduction to the basic concepts and principles of thermodynamics and their applications in science and engineering.

**[到達目標]**

The aim of this course is to achieve a comprehensive understanding of the fundamental concepts and principles of thermodynamics and their applications in science and engineering.

As the main outcomes of this course students should

- I. Gain a comprehensive understanding of thermodynamic principles and be able to apply them to engineering problem solving
- II. Be able to quantify energy transfer in thermodynamic systems

## 【授業計画と内容】

The following topics will be covered in this course:

- Lecture 1) Introduction and areas of application of thermodynamics
- Lecture 2) State of equilibrium, thermodynamic property of substance (equation of state, heat capacity), heat and work, state variables, quasi-static processes
- Lecture 3) First Law of Thermodynamics, equivalence of heat and work, internal energy, Thermodynamic processes
- Lecture 4) Heat Engines and Introduction to Second Law of Thermodynamics
- Lecture 5) Second Law of Thermodynamics, Kelvin-Planck statement, Clausius statement, perpetual motion
- Lecture 6) Entropy and the Clausius Inequality
- Lecture 7) Carnot Engine, Carnot Efficiency
- Lecture 8) Principle of increase of entropy, entropy variation for an ideal gas
- Lecture 9) Exergy and introduction to Thermodynamic Potentials
- Lecture 10) Thermodynamic potentials and property relations, Enthalpy
- Lecture 11) Helmholtz Free Energy, Gibbs Free Energy
- Lecture 12) Summary of thermodynamic property relations, derivation and application of Maxwell relations
- Lecture 13) Heat capacity in differential forms, the Joule-Thomson effect
- Lecture 14) Phase transition, the Clapeyron equation, the Clapeyron-Clausius equation

\* The lectures will be followed by Final Exam (Week 15) and then Feedback (Week 16).

**\*\* For Feedback the answers to Final Exam will be sent to Students using KULASIS in a few hours after the exam and students can visit instructor's office on the Feedback day (one week after final exam) for discussions towards comprehensive learning.**

## Thermodynamics(2)

### 【履修要件】

Having taken the course "Fundamental Physics A" is preferable.

### 【成績評価の方法・観点】

Evaluation is based on

- 1) Final Exam (50 points),
- 2) Assignments, Quizzes & Class Discussions (50 points)

- Class discussions will contribute as bonus points.
- Best 2 quizzes (out of 4) will be considered for evaluation.
- Students being absent for 5 lectures or more will not be credited.

### 【教科書】

授業中に指示する

### 【参考書等】

(参考書)

授業中に紹介する

### 【授業外学修（予習・復習）等】

- After each class students are encouraged to review the handouts and presentation files thoroughly, and work on the given assignments

### 【その他（オフィスアワー等）】

- No office hour specified. However, students are encouraged to ask their questions before or after each lecture or via email.

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- Lectures are conducted by using both PowerPoint presentation and board.