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	2026・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.

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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.
Email: khayyer@particle.kuciv.kyoto-u.ac.jp
- Lectures are conducted by using both PowerPoint presentation and board.

[主要授業科目（学部・学科名）]

理学部