

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------------------------------------------------------------------------------------------|-----|--------|--------|------|----------------|------|-----------------------------------------|--|--|
| 科目ナンバリング                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         | U-LAS13 10004 LE60                                                                           |     |        |        |      |                |      |                                         |  |  |
| 授業科目名<br><英訳>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         | Basic Physical Chemistry (thermodynamics)-E2<br>Basic Physical Chemistry (thermodynamics)-E2 |     |        |        |      | 担当者所属<br>職名・氏名 |      | エネルギー理工学研究所 講師<br>ARIVAZHAGAN RAJENDRAN |  |  |
| 群                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 自然科学科目群 |                                                                                              |     | 分野(分類) | 化学(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・<br>開講期                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2025・前期 |                                                                                              | 曜時限 | 木3     |        | 配当学年 | 全回生            | 対象学生 | 理系向                                     |  |  |
| [授業の概要・目的]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| We learn about the thermodynamics in the state-change of matter, also in the chemical reactions. Contents of the lecture covers the following fields of change of state, thermodynamic laws, definition of the quantities (enthalpy, entropy, free energy, chemical potential), chemical equilibrium, and reaction kinetics. Aim of this course is the understanding of these concepts.                                                                                                                                                                                                                                                                                                                                                                                       |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| [到達目標]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| The aim of this class is to understand the basic principles of thermodynamics.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| [授業計画と内容]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| 1. Change of the system and quantity of state<br>2. Thermal energy and work<br>3. 1st law of thermodynamics: Change of internal energy and enthalpy<br>4. Chemical reaction and thermal energy<br>5. Interpretation of internal energy in molecular level<br>6. Change of state of the ideal gas<br>7. 2nd law of thermodynamics: Entropy<br>8. Entropy change in the change of state<br>9. 3rd law of thermodynamics: Conversion from heat to work<br>10. Gibbs energy<br>11. Change of the Gibbs energy when temperature and pressure change<br>12. Chemical potential<br>13. Change of state and chemical potential change of matter<br>14. Chemical equilibrium and rate of chemical reaction<br>15. Assignment which is considered as a term examination<br>16. Feedback |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| [履修要件]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| 特になし                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| [成績評価の方法・観点]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| Results will be evaluated by the submission of homework written in English (30%), attendance and discipline (20%), and assignment which is considered as a term examination (50%).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| -----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |
| Basic Physical Chemistry (thermodynamics)-E2(2)へ続く↓↓↓                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |         |                                                                                              |     |        |        |      |                |      |                                         |  |  |

Basic Physical Chemistry (thermodynamics)-E2(2)

**[教科書]**

Yunus A. Cengel and Michael A. Boles 『Thermodynamics: An Engineering Approach, 8th Edition in SI Units』 ( McGraw-Hill Education ) ISBN:978-981-4595-29-2

Peter Atkins and Julio de Paula 『Atkins' Physical Chemistry, 10th Edition』 ( Oxford University Press ) ISBN:978-0-19-969740-3

**[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]**

I recommend that the students should review the points to be learned.

**[その他 ( オフィスアワー等 ) ]**

Office hours are set at 15:00-17:00 in every Friday.

**[主要授業科目 ( 学部・学科名 ) ]**

理学部