| Akashi College | Year | 2021 | Course Title | Thermodynamics Ⅱ |
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## Course Information

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| Course Code | 0123 | Course Category | Specialized / Elective |
| Class Format | Lecture | Credits | School Credit: 1 |
| Department | Mechanical Engineering | Student Grade | 5th |
| Term | Second Semester | Classes per Week | 2 |
| Textbook and/or Teaching Materials | | | |
| Instructor | MAKI Shou | | |

## Course Objectives

The aim of this course is to understand the following issues concerning thermodynamics:
(1) Understand the Rankine cycle.
(2) Understand regeneration, reheat, and combined cycle.
(3) Understand the freezing cycle.
(4) Understand the basics and applications of magnetic thermal convection.

## Rubric

| | Ideal Level | Standard Level | Unacceptable Level |
|---|---|---|---|
| Achievement 1 | Fully understand the Rankine cycle. | Understand the Rankine cycle. | Do not understand the Rankine cycle. |
| Achievement 2 | Fully understand regeneration, reheat, and combined cycle. | Understand regeneration, reheat, and combined cycle. | Do not understand regeneration, reheat, and combined cycle. |
| Achievement 3 | Fully understand the freezing cycles. | Understand the freezing cycles. | Do not understand the freezing cycles. |
| | Fully understand the basics and applications of magnetic thermal convection. | Understand the basics and applications of magnetic thermal convection. | Do not understand the basics and applications of magnetic thermal convection. |

## Assigned Department Objectives

学習・教育到達度目標 (D) 学習・教育到達度目標 (H)

## Teaching Method

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| Outline | In this lecture, students will first learn about steam-based thermal cycles, or the Rankine cycle. Then, they will learn about compound cycles with combination of the Brayton cycle, and frozen cycles. In the second half of the semester, they will learn about the basics of heat transfer, and learn about the basics and applications of magnetic heat convection. |
| Style | Classes will be held in a lecture style. There will be assignments in every lesson to deepen understanding. (Liaison Seiichi Tanaka) |
| Notice | Rather than memorizing knowledge, interpret basic thinking in your own mind. Ask questions actively if you don't understand.<br>Students who miss 1/3 or more of classes will not be eligible for a passing grade. |

## Characteristics of Class / Division in Learning

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| ☑ Active Learning | ☐ Aided by ICT | ☑ Applicable to Remote Class | ☐ Instructor Professionally Experienced |

## Course Plan

| | | | Theme | Goals |
|---|---|---|---|---|
| 2nd Semester | 3rd Quarter | 1st | P-v diagram of the water evaporation phenomenon and steam | Consider the evaporation of water with phase change and study the p-v diagram. |
| | | 2nd | Water and water vapor state quantities and vapor wire diagrams | Learn about water and steam states, and learn about the Mollier diagram. |
| | | 3rd | Vapor state change | Learn about isothermal, isochoric, isotropic, and adiabatic changes in steam, as well as heat and work. |
| | | 4th | Rankine cycle 1 | Learn about power and thermal efficiency in the Rankine cycle. |
| | | 5th | Rankine cycle 2 | Learn about regeneration, reheat, and compound cycles. |
| | | 6th | Refrigeration cycle | Learn about commonly used steam freezing cycles. |
| | | 7th | Exercise | Familiarize with the thermal cycles and condition diagrams during the exercise. |
| | | 8th | Midterm exam | |
| | 4th Quarter | 9th | Basic heat transfer and steady-state heat transfer | Learn about Fourier's law, Newton's cooling law, and more about steady-heat transfer problems (one-dimensional plate and in-vitro heat transfer). Also learn about the concept of thermal resistance. |
| | | 10th | Transient heat transfer problems and conduction heat transfer exercises | Learn about the analytical method for deriving transient heat transfer problems in the semi-infinite body. Also, carry out exercises on heat transfer issues to facilitate the consolidation of knowledge of students and what they have learned. |

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| | | 11th | Forced convection heat transfer | Understand the fundamentals and characteristics of forced convection heat transfer in relation to learning contents in Fluid Dynamics. Also, encourage the understanding of dimensionless numbers by deriving dimensionless equations of motion. |
| | | 12th | Natural convection heat transfer | Learn about the basics and characteristics of natural convection heat transfer. Understand the non-dimensional equation of basic equations introduced with Boussinesq approximation. Understand the concept of temperature boundary layers and the characteristics of the Benard convection described by the Prandtl number and the Rayleigh number. |
| | | 13th | Magnetic thermal convection | Learn about the mechanism for controlling thermal convection by magnetic field with the method of dimensionless basic equations. In addition, touch on the possibilities for industrial applications. |
| | | 14th | Radiative and convection heat exercises | Learn about the basics of radiation heat transfer. Aim to retain knowledge through exercises on convection heat transfer. |
| | | 15th | Summary | Organize what the students learned in this course as an overview. |
| | | 16th | Final exam | |

Evaluation Method and Weight (%)

| | Examination | Task | Mutual Evaluations between students | Behavior | Portfolio | Other | Total |
|---|---|---|---|---|---|---|---|
| Subtotal | 90 | 10 | 0 | 0 | 0 | 0 | 100 |
| Basic Proficiency | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Specialized Proficiency | 90 | 10 | 0 | 0 | 0 | 0 | 100 |
| Cross Area Proficiency | 0 | 0 | 0 | 0 | 0 | 0 | 0 |