Akashi College	Year	2022	Course Title	Thermodynamics I

Course Information

Course Code	4427	Course Category	Specialized / Compulsory
Class Format	Lecture	Credits	Academic Credit: 2
Department	Mechanical Engineering	Student Grade	4th
Term	First Semester	Classes per Week	2
Textbook and/or Teaching Materials			
Instructor	FUJIWARA Seiji		

Course Objectives

The goal is to understand and calculate the following basic concepts of industrial thermodynamics.
(1) Can calculate heat and work power and understand them on the p-V diagram.
(2) Understand the equation for the first law of thermodynamics and can perform various calculations.
(3) Can calculate change in state of a cycle using perfect gas as an operating substance and thermal efficiency.
(4) Understand the Carnot cycle, and can calculate entropy changes in perfect gas.
(5) Can convert the P-V diagram of the cycle to the T-S diagram, and understand the heat received and heat dissipated.
(6) Can calculate energy loss, and understand the effective use of energy.
(7) Can calculate the general equation of thermodynamics.

Rubric

	Ideal Level	Standard Level	Unacceptable Level
Achievement 1	Can calculate heat and work power and fully understand them on the p-V diagram.	Can calculate heat and work power can and understand them on the p-V diagram.	Cannot calculate heat and work power. Cannot understand them on the p-V diagram.
Achievement 2	Understand the equation for the first law of thermodynamics, and can fully perform various calculations.	Understand the equation for the first law of thermodynamics, and can perform various calculations.	Do not understand equation for the first law of thermodynamics, and cannot perform various calculations.
Achievement 3	Can fully calculate on the change of state of a cycle with perfect gas as the operating material and the thermal efficiency.	Can calculate the change of state of a cycle with perfect gas as the operating material and the thermal efficiency.	Cannot calculate the change of state and thermal efficiency of the cycle with perfect gas as the operating material cannot be calculated.
	Fully understand the Carnot Cycle, and can fully calculate entropy changes in perfect gas.	Understand the Carnot Cycle, and can calculate entropy changes in perfect gas.	Do not understand the Carnot cycle, and cannot calculate entropy changes in perfect gas.
	Can convert the p-V diagram of the cycle smoothly into the T-S diagram, and fully understand the heat received and heat dissipated.	Can convert the p-V diagram of the cycle into the T-S diagram, and understand the heat received and heat dissipation.	Cannot convert the p-V diagram of the cycle into the T-S diagram, and do not understand the heat received and heat dissipation.
	Can fully calculate the energy loss, and deeply understand the effective use of energy.	Can calculate the energy loss, and understand the effective use of energy.	Cannot calculate energy loss, and do not understand the effective use of energy.
	Can fully calculate general equations for thermodynamics.	Can calculate general equations for thermodynamics.	Cannot calculate the general equation for thermodynamics.

Assigned Department Objectives

Teaching Method

Outline	By converting heat into power, mankind has formed a huge industrial society and affluent life. The main purpose of the thermodynamics lecture is to learn about the cycle as a heat and power converter and its conversion efficiency. To do this, students will learn about basic concepts and energy conservation principles related to heat and work, then the nature and state changes of operating materials, including perfect gas, and how to determine the thermal efficiency of the cycle. Students will then learn about industrially-critical steam and steam cycles. In addition, students will learn about the effective use of energy from the concept of entropy and energy.
Style	Classes will be held in a lecture style. There will be assignments in every lesson to deepen understanding. (Liaison: Seiichi Tanaka)
Notice	This course's content will amount to 90 hours of study in total. These hours include the learning time guaranteed in classes and the standard self-study time required for pre-study / review, and completing assignment reports. Since the knowledge system of thermodynamics is simple and when it becomes a basic concepts, the overall structure becomes visible as they get familiar with the basic concept, students should take notes and make the basic concepts familiar to the heart and mind. Also, the exercise problems in the textbook have detailed answers, so try them out. Students who miss 1/3 or more of classes will not be eligible for a passing grade.

Characteristics of Class / Division in Learning

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

Course Plan

			Theme	Goals
1st Semester	1st Quarter	1st	Temperature, heat and pressure and work (1)	Understand the thermodynamic concepts such as temperature, heat power, specific heat, and sensible and latent heat. Learn about the work of pressure and pressure, and can calculate the absolute work of a closed system.

		2nd	Pressure and work (2) and the first law of thermodynamics and internal energy	Can calculate industrial work in an open system. Learn about Joule's experiments and the law of the conservation of energy, and understand the energy formula of a closed system with the concept of internal energy.
		3rd	The first law of thermodynamics and the state formula of enthalpy and complete gas, internal energy and specific heat	Can determine the energy formula of an open system and the energy formula of a fluidized system, and understand the concept of enthalpy. Understand the equation between pressure-volume-temperature of a complete gas, the properties of internal energy and specific heat.
		4th	Equation for the first law of thermodynamics of perfect gas	Understand the equation for the first law of thermodynamics of perfect gas.
		5th	Perfect gas change of state	Learn about equations of perfect gas for isothermal, isotropic, isotopic, and insulation changes and polytropic change and heat and work in the change.
		6th	Reversible and irreversible changes and Carnot cycles	Learn about the reversible and irreversible processes of state change and whether it is the maximum thermal efficiency and the power and thermal efficiency of the Carnot cycle.
		7th	Integration of Clausius and entropy	Learn how the Carnot Cycle leads to the integration of Clausius and the amount of state called entropy.
		8th	Midterm exam	
	2nd Quarter	9th	Complete gas state change and T-S diagram	The various state changes of complete gas are drawn on the T-S and p-v diagrams, and the heat and deal with work power hand heat received.
		10th	The second law of thermodynamics and the law of entropy growth	Learn that entropy grows in the irreversible process and become familiar with the concept of entropy.
		11th	Irreversible change and the second law of thermodynamics	Learn that the irreversible process degrades the performance of the thermal cycle.
		12th	The thermal cycle of the internal combustion engine	Learn about the Otto cycle, Diesel cycle and Sabathe cycle about work and thermal efficiency.
		13th	Gas turbine cycle and exergy and anergy	Learn about Brayton cycle and its work and thermal efficiency. Then, learn about the exergy of thermal energy and consider the effective use of energy.
		14th	General equations for thermodynamics	Learn about the various general equations used in thermodynamics.
		15th	General equations for thermodynamics	Learn about the various general equations used in thermodynamics.
		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