Tsuyama College	Year	2021	Course Title	Energy System Engineering

Course Information

Course Code	0015	Course Category	Specialized / Elective
Class Format	Lecture	Credits	Academic Credit: 2
Department	Advanced Mechanical and Control System Engineering Course	Student Grade	Adv. 1st
Term	Second Semester	Classes per Week	2
Textbook and/or Teaching Materials	Textbooks: Distribution prints, heat transfer, Tetsuo Hirata et al. "Heat transfer engineering understood by examples" (Morikita Publishing), Reference books: Meng Saito "Basics of Industrial Thermodynamics" (Science), Tadanori Kojima et al. "Ace Fluid Dynamics" "(Asakura Shoten) etc		
Instructor	HOSOTANI Kazunori,SAEKI Fumihiro		

Course Objectives

Purpose of learning: To acquire basic knowledge about energy conversion and thermal energy, and to deepen understanding of mechanical design methods considering effective use of energy.

Achievement goal:
1. You can deepen the expertise you have acquired in thermodynamics and fluid engineering.
2. You can deepen your knowledge of the theoretical cycle and understand the correspondence with the actual device.
3. 3. Understand the basic forms of heat transfer and explain the heat transfer mechanism in each form.
4. Understand and explain how to evaluate the performance of heat exchanges.

Rubric

	Ideal Level	Standard Level	Acceptable Level	Unacceptable Level
Achievement 1	Understand and explain the specialized knowledge acquired in thermodynamics and fluid engineering, and deepen the application.	Understand and explain the expertise gained in thermodynamics and fluid engineering.	Recognizes the expertise gained in thermodynamics and fluid engineering.	It has not reached the left.
Achievement 2	While deepening the knowledge of the theoretical cycle, you can understand and explain the correspondence with the actual device, and even apply it.	While deepening the knowledge of the theoretical cycle, understand and explain the correspondence with the actual device.	We are aware of the correspondence between the theoretical cycle and the actual device.	It has not reached the left.
Achievement 3	The basic rules for the basic form of heat transfer can be applied to specific problems.	Understand the basic rules for the basic form of heat transfer and explain using mathematical formulas.	Explain the basic form of heat transfer in relation to familiar phenomena and engineering techniques.	It has not reached the left.
Achievement 4	The heat exchanger performance evaluation method can be applied to specific problems.	Understand and explain how to evaluate the performance of heat exchangers.	Explain the structure and function of heat exchangers.	It has not reached the left.

Assigned Department Objectives

Teaching Method

Outline	General / Specialty: Specialty / Energy and Flow Learning Purpose: Acquire basic knowledge about energy conversion and thermal energy, and deepen understanding of mechanical design methods considering effective use of energy. Mandatory / Choice: Basic field of choice : Engineering / Mechanical Engineering / Thermal Engineering Major Relationship with Learning Objectives: This subject is the subject's Learning Objectives "(2) Materials and Structure, Motion and Vibration, Energy and Flow" , Acquire knowledge of specialized fields of technology such as information and measurement / control, design and production / management, machines and systems, and acquire the ability to utilize them for design, policy, and operation of machines and systems. " is there. Relationship with engineer education program: The main goals of learning / education in this subject are "(A) Deepening of basic knowledge about technology, A-2:" Materials and structure "," Movement and vibration "," Energy and To be able to acquire and explain the knowledge of specialized technical fields related to "flow", "information and measurement / control", "design and production / management", and "machines and systems". Concomitantly, it is also involved in "A-1". Outline of class: Based on the thermodynamics and fluid engineering learned in this department, we will outline various cycles and heat conduction / heat transfer. We will explain the performance evaluation method of familiar cycles and the basics of mechanical design considering thermal energy transfer.
Style	Class method: Classes will be conducted with board writing, projectors, and tabletop experiments while confirming expertise in thermodynamics and fluid engineering. Consider the application to actual problems and take care to deepen the understanding of basic theory through exercises. Grade evaluation method: The grades of the two exams are evaluated equally (70%), and the total evaluation is made by adding exercises, assignments (reports), and learning outcomes outside class hours (30%). Guidance will explain how to bring textbooks (distributed prints), autograph notes, etc. to the exam.

Notice	Precautions for taking this course: This course is a "course that requires study outside of class hours". Course advice: Basic knowledge of thermodynamics and fluid engineering is a prerequisite. Foundation courses: Differential and Integral I (2nd year), Differential and Integral II (3rd), Mechanics III (3rd), Introduction to Thermodynamics (3rd), Thermodynamics (4th), Fluid engineering (4th), Heat transfer engineering (5th), Energy Conversion Engineering (5th), etc. related Subject: Mechanical / Control System Special Experiment (Adv. 1st year), Fluid mechanics (Adv. 2nd) Advice on attendance: Voluntary for exercises and given tasks to be conducted during class to deepen understanding of class Work positively. Late arrivals over 20 minutes are considered absent.

Characteristics of Class / Division in Learning

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

Elective subjects

Course Plan

			Theme	Goals
2nd Semester	3rd Quarter	1st	・ Outline of the lecture [Guidance] ・ Learning outside class hours: Imposing preparation and review of assignments. Problem (1) [Basics of thermodynamics]	
		2nd	・ Basics of thermodynamics (energy type of open system and closed system, ・ heat pump) ・ Learning outside class hours: Task (2) [Heat pump]	Understand and explain the items on the left.
		3rd	・ Air standard cycle (Carnot cycle, Brayton cycle, etc.) ・ Learning outside class hours: Tasks (3) [Thermal efficiency of the cycle]	Understand and explain the items on the left.
		4th	・ Characteristics of steam (steam table, conversion state formula, etc.) ・ Learning outside class hours: Exercise (4) [Steam state]	Understand and explain the items on the left.
		5th	・ Steam cycle ① (Basics of Rankine cycle) ・ Learning outside class hours: Assignment (5) [Steam cycle]	Understand and explain the items on the left.
		6th	・ Steam cycle ② (composite cycle, multi-stage cycle) ・ Learning outside class hours: Assignment (6) [composite cycle]	Understand and explain the items on the left.
		7th	・ Application of steam cycle ・ Learning outside class hours: Task (7) [Application of heat pipe]	Understand and explain the items on the left.
		8th	Mid-term exam	
	4th Quarter	9th	・ Guidance ・ Three modes of heat transfer (heat conduction, convective heat transfer, radiation heat transfer)・ Fundamentals of heat conduction (the Fourier's law)	Understand and explain the items on the left.
		10th	・ Heat conduction problem (heat conduction equation,overall heat transfer) ・ Learning outside class hours: Task (1) Heat conduction and overall heat transfer	Understand and explain the items on the left.
		11th	・ Convective heat transfer (heat transfer coefficient, heat transfer equation) ・ Learning outside class hours: Task (2) Forced-convection heat transfer	Understand and explain the items on the left.
		12th	・ Heat exchanger 1 (heat-transfer rate, logarithmic mean temperature difference) ・ Learning outside class hours: Task (3) Logarithmic mean temperature difference	Understand and explain the items on the left.
		13th	・ Heat exchanger 2 (temperature efficiency, number of heat transfer units) ・ Learning outside class hours: Task (4) Temperature efficiency	Understand and explain the items on the left.
		14th	・ Condensation and boiling heat transfer ・ Learning outside class hours: Task (5) Film condensation	Understand and explain the items on the left.
		15th	・ Radiation heat transfer (mechanism of radiation heat transfer, black/gray/real surfaces, view factors) ・ Learning outside class hours: Task (6) Radiation exchange	Understand and explain the items on the left.
		16th	・ Final exam	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Report	Other	Total
Subtotal	70	0	0	0	30	0	100

Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	70	0	0	0	30	0	100
Cross Area Proficiency	0	0	0	0	0	0	0