Course Title	Introduction to Energy Systems Analysis
Registration Code	L100110001
Number of Credits	2
Years of Eligible Graduate Students	1-2
Semester	1st
Period	Fri. 4th
Room	B4-EK-301 (Nakamozu Campus, OPU)
Instructors	Ryohei Yokoyama
Office hours	Any time
Contact	B4 W328, Tel: 072-254-9229, E-mail: yokyama@me.osakafu-u.ac.jp
Goals of the course	The goal of this course is to understand the basic knowledge of various analysis to analyse and evaluate the performance of evergy systems from the system engineering viewpoint, the basic laws, the numerical solutions and the examples of applications, as a basis of rational performance of the design, operation, and control of energy systems. Additionally, the achievement goal is to acquire the following abilities: 1. to understand and apply relational expressions for energy analysis 2. to understand and apply steady energy analysis methods 3. to understand and apply exergy analysis methods 4. to understand exergy and economic analysis methods and application examples 5. to understand and apply pinch analysis methods 6. to understand unsteady energy analysis methods and application examples
Textbooks	not specified. Printed materials will be distributed.
Books of reference	not specified.
Allied subject	Energy system engineering, Energy system planning theory
Homework (Preparing for the classwork)	It is not possible to understand the contents of the lecture only by class hours nor radicate the understanding. Preparation is needed as same as review. You should confirm the outline of the contents descibed on "Class schedule" in the distributed printed materials, and investigate the items which you can not understand.
Course outline	From the viewpoint of energy saving, environmental conservation, and economy, rational design, operation and control of the whole system are important in the energy system. In this class, we outline the technical issues of the various systems on energy supply and consumption, as well as lecture about the basic thinking of various analyses, the basic law to apply and the numerical solutions to analyse and evaluate the performance of the energ system from the system engineering viewpoint, by taking a distributed energy supply system such as cogeneration as an application example. Details of the lecture are described below.
Class schedule 1st	Overview for energy systems analysis: Lecture the concept of system engineering necessary for the analysis and the optimization for energy system
2nd	Fundamentals for energy analysis (1): Lecture the basic relational expressions necessary for energy analysis to calculate the various type of state variable on the process of energy conversion of energy system. <goal> Can understand and apply the relational expressions for energy analysis

3rd	Fundamentals for energy analysis (2): Lecture the basic relational expressions necessary for nergy analysis. <goal> Can understand and apply the relational expressions for energy analysis
4th	Steady energy analysis (1): Lecture the relational expressions and the numerical solution necessary for energy analysis on steady state. <goal> Can understand and apply the steady energy analysis
5th	Steady energy analysis (2): Lecture the analysis examples of gas turbines and heat pumps as the application examples of energy analysis on steady state. <goal> Can understand and apply the steady energy analysis
6th	Exergy analysis (1) : Lecture the evaluation methods of various exergy, considering the quantity and quality of energy. <goal> Can understand and apply the methods of exergy analysis.
7th	Exergy analysis (2): Lecture the basic of exergy analysis to calculate the quantity of various exergy on the process of energy conversion of energy system. <goal> Can understand and apply the methods of exergy analysis.
8th	Exergy analysis (3): Lecture the analysis examples of gas turbine cogeneration system as the application examples of exergy analysis. <goal> Can understand and apply the methods of exergy analysis.
9th	Exergy and economic analysis (1): Lecture the basic of exergy and economic anaysis to evaluate energy system from the angles of exergy and economic efficiency. <goal> Can understand the method and application examples of exergy and economic analysis.
10th	Exergy and economic analysis (2): Lecture various evaluation index used for exergy and economic analysis <goal> Can understand the method and application examples of exergy and economic analysis.
11th	Exergy and economic analysis (3): Lecture the analysis examples of gas turbine cogeneration system as the application examples of exergy and economic analysis <goal> Can understand the method and application examples of exergy and economic analysis.
12th	Pinch analysis (1): Lecture the basic and application examples to perform maximam heat recovery on heat-exchange network. <goal> Can understand and apply the method of pinch analysis.
13th	Pinch analysis (2): Lecture the basic and application examples of the design of heat-exchange network based on pinch analysis. <goal> Can understand and apply the method of pinch analysis.
14th	Pinch analysis (3): Lecture the valid combination for heat-exchange network and heat engine/heat pump. <goal> Can understand and apply the method of pinch analysis.
15th	Unsteady energy analysis: Lecture the basic of energy analysis and numerical solution on an unsteady state. <goal> Can understand the method and application examples of unsteady enery analysis
16th	Examination

Evaluation	Considering the Achievement goals 1-6, students are evaluated by attendance (20%), report (30%), and routine examination (50%). Evaluation ratios in each goals of the course are 1. 15%, 2. 15%, 3. 25%, 4. 15%, 5. 25% and 6. 5%. Passes an average score 60 points or more.
Remarks	