

Combustion Engineering

Syllabus Number

1C303

Special Subjects

Elective 2 credit

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1. Course Description

Students will learn about the kinds of fuel, the basics, calculation methods, and thermodynamics of combustion, combustion forms of gas, liquid, and solid fuel. They must first recognize the concept from the textbook via learning and lectures, next practice combustion calculation so as to gain a deep understanding. In the latter part of this course, they will learn the characteristics of flames, combustion control technologies such as prevention of air pollution and combustion measurement techniques considering recent improvements in technology.

2. Course Objectives

Combustion engineering as a field of mechanical engineering and is the theoretical basis for many combustion processes such as various industrial furnaces, internal combustion engines for automobile and other uses, boilers for thermal power generation and so on. In this course, students learn the basic theories and knowledge required when they treat the processes and devices concerning combustion phenomena as mechanical engineers in the future. Another aim of this course is understanding how combustion engineering is useful in real industrial processes.

3. Grading Policy

Students will be evaluated based on periodic test (90%) and report assignment (10%). It is a requirement in order to acquire credits, students must meet the requirement of 2/3 or more in attendance. The submitted reports will be corrected and returned.

4. Textbook and Reference

Textbook

Yukio Mizutani Combustion engineering (3rd edition) Morikita Shuppan Co., Ltd.

5. Requirements(Assignments)

It is important that you fully understand Chemistry 1, Chemistry 2 and Thermodynamics. Always read the textbook before the next lesson which was described in the 1st and 2nd class contents of the lesson. Note down the part which you don't understand (about 1 - 1.5 hours). After class, review what you have learned, organize your notes and solve the exercises given (about 1 - 2 hours). Please submit the assignment as a report at the beginning of the next lesson.

6. Note

Please bring a scientific calculator as you may need to practice examples. Progress may be followed by degree of comprehension, so we will specifically tell you the review subject and the next preparatory range at each lesson. The contents of the assignment will also be posted on LMS.

7. Schedule

- [1] Outline of Combustion Engineering
[Preparation] Review the burning description part (p. 31 - 38) of Chapter 2 of the "Thermodynamics" textbook of the second year and clarify the image of learning content on combustion phenomena.
[Review] Understand the notes taken in class and organize them.
- [2] Fuel type -1 (solid fuel)
[Preparation] To read through p.1 - 9 of the first chapter of the textbook, to clarify the point which can not be understood and to go to class.
[Review] Organize and understand lesson notes, solve the exercise question (1) on p.25, and submit it as a report at the next class start.
- [3] Fuel type 2 (liquid / gaseous fuel)
- [4] Basics of Combustion
- [5] Combustion calculation -1 (stoichiometric ratio, calorific value, etc.)
- [6] Combustion calculation -2 (combustion product gas, theoretical combustion temperature, etc.)
- [7] Combustion calculation -3 (combustion efficiency, thermal efficiency, etc.)
- [8] Thermodynamics of combustion and chemical equilibrium
- [9] Combustion of gaseous fuel - 1 (classification of combustion, premixed combustion)
- [10] Burning of gaseous fuel - 2 (ignition, self-ignition, diffusion combustion)
- [11] Combustion of liquid fuel
- [12] Combustion of solid fuel
- [13] Flame emission and thermal radiation
- [14] Production of air pollutants, energy saving combustion, measurement of combustion
[Group work] Group discussion will be held on the current situation of environmental problems and solutions.
- [15] Summary of general combustion engineering and review