JEE 642 Fuel and Combustion

(Course coordinator: Assoc.Prof.Dr. Nakorn Worasuwannarak)

1. Course Description

This course aims to give students with the basic concepts of combustion processes. Classification of fuels. Properties and characterization of gaseous, liquid and solid fuels. Characteristics of the combustion flame. Stoichiometry. Thermodynamics of combustion. Chemical kinetics of combustion. Energy balance and furnace efficiency. Overview on major combustion technologies for solid, liquid and gaseous fuels. Clean coal technologies.

2. Target Knowledge, Skills, and Abilities (KSA)

Indicate what KSA this course will provide the students with.

This course provides students with knowledge of combustion processes. The skills to analyze fuels and various types of combustion systems will be provided.

3. Target group of students

Indicate if the course is opened for all students, including non-degree ones.

This course is opened to Master and PhD students with a background in science or engineering.

4. Pre-requisites

Indicate if the course requires some pre-requisites.

No pre-requisites are required.

5. Course Learning Outcomes

Indicate the alignment of CLOs with the PLOs.

CLO 1: Able to classify fuels and explain the concept of combustion processes.

CLO 2: Able to explain the principles of major combustion technologies for solid, liquid, and gaseous fuels.

CLO 3: Able to analyze the environmental impacts of various types of combustion processes.

6. Method of Teaching and Learning

Specify if it would be 1/ Online; 2/ On-site; 3/ Hybrid; 4/ Online for lectures and On-site in small groups for discussions and workshops; 5/ Others.

This course will be delivered in a hybrid format, i.e. a combination of online and on-site lectures and presentations.

7. Course Outline and Organization

Following KMUTT's recommendations, a course should be organized based on the OBEM approach. A course can, therefore, be split over the semester, but also organized in consecutive weeks as before. A module can contain from 2 up to a maximum of 5 lectures depending on the target LOs. A 3 credits course

can be composed of 3 to a maximum of 5 modules. In addition, indicate if ***the course is opened every Semester or a specific Semester***.

addition, indicate if ***the course is opened every Semester or a specific Semester***].

This course is opened every Semester. For the Semester 2/2024 (2567), this course is scheduled every Wednesday afternoon (1.30 p.m. – 4.30 p.m.) from 15 January 2025 to 7 May 2025.

MODULE 1: FUEL CLASSIFICATION, COMBUSTION STOICHIOMETRY, THERMODYNAMICS OF COMBUSTION, BOILER HEAT BALANCE AND EFFICIENCY **MLO 1:** Understand the fuel classification and characterization. **MLO 2:** Understand combustion stoichiometry. **MLO 3:** Understand thermodynamics of combustion. **MLO 4:** Understand the boiler heat balance and efficiency.		
Lecture No.: Title	Name of Instructor (Affiliation)	Teaching Period
LECTURE 1: Fuel classification and characterization	Dr. Nakorn Worasuwannarak	15 Jan 2025
LECTURE 2: Combustion stoichiometry	Dr. Nakorn Worasuwannarak	22 Jan 2025
LECTURE 3: Thermodynamics of combustion	Dr. Nakorn Worasuwannarak	29 Jan 2025
LECTURE 4: Boiler heat balance and efficiency	Dr. Nakorn Worasuwannarak	5 Feb 2025
EVALUATION: Essay questions and take-home work		

MODULE 2: CHEMICAL KINETICS OF COMBUSTION, COMBUSTION MODELS, COMBUSTION TECHNOLOGIES FOR SOLID FUELS **MLO 1:** Gain knowledge on chemical kinetics of combustion **MLO 2:** Gain knowledge on combustion model		
Lecture No.: Title	Name of Instructor (Affiliation)	Teaching Period
LECTURE 1: Chemical kinetics of combustion	Dr. Nakorn Worasuwannarak	19 Feb 2025
LECTURE 2: Combustion models I	Dr. Nakorn Worasuwannarak	26 Feb 2025
LECTURE 3: Combustion models II	Dr. Nakorn Worasuwannarak	5 Mar 2025
EVALUATION: Essay questions and take-home work		

MODULE 3: COAL & BIOMASS POWER PLANTS, OTHER SOLID FUEL CONVERSION TECHNOLOGIES, CLEAN COAL TECHNOLOGIES, POLLUTANT FORMATION AND REDUCTION TECHNIQUES **MLO 1:** Gain knowledge on combustion technologies for solid fuels **MLO 2:** Gain knowledge on other solid fuel conversion technologies **MLO 3:** Gain knowledge on clean coal technologies **MLO 4:** Gain knowledge on pollutant formation and reduction techniques		
Lecture No.: Title	Name of Instructor (Affiliation)	Teaching Period
LECTURE 1: Combustion technologies for solid fuels	Dr. Nakorn Worasuwannarak	12 Mar 2025
LECTURE 2: Other solid fuel conversion technologies	Dr. Nakorn Worasuwannarak	19 Mar 2025
LECTURE 3: Clean coal technologies	Dr. Nakorn Worasuwannarak	26 Mar 2025
LECTURE 4: Pollutant formation and reduction techniques	Dr. Nakorn Worasuwannarak	2 Apr 2025
EVALUATION: Essay questions and take-home work		

MODULE 4: GAS & LIQUID COMBUSTION, GAS BURNER AND ITS APPLICATION, GAS TURBINE COMBUSTION

MLO 1: Gain knowledge on gas & liquid combustion **MLO 2:** Gain knowledge on bas burner and its application **MLO 3:** Gain knowledge on gas turbine combustion		
Lecture No.: Title	Name of Instructor (Affiliation)	Teaching Period
LECTURE 1: Gas & liquid combustion	Dr. Amornrat Kaewpradap	9 Apr 2025
LECTURE 2: Gas burner and its application	Dr. Amornrat Kaewpradap	23 Apr 2025
LECTURE 3: Gas turbine combustion	Dr. Amornrat Kaewpradap	30 Apr 2025
EVALUATION: Exam papers		7 May 2025

Note: *You may modify this template (number of modules, lectures and MLOs) as appropriate for your course.*

8. Evaluation Methods

Indicate the methods used to evaluate the LOs, e.g. online or on-site exams, assignments, take-home exams, projects, etc. Following KMUTT's recommendations, the LOs evaluation should be organized at the end of each module.

Dr. Nakorn	78 %
Dr. Amornrat	22 %

9. References/Resources

Indicate the references/resources students are recommended to consult for the modules/course.

1. Bhatt B. I. and Vora S. M., Stoichiometry, 4th Edition, Tata McGraw-Hill
2. Yunus A. Çengel and Michael A. Boles, Thermodynamics: An engineering approach, 5th Edition, McGraw-Hill
3. D.W. van Krevelen, 1993. *Coal: Typology-Physics-Chemistry-Constitution*. Elsevier Science Ltd.
4. F. El-Mahallawy and S. El-Din Habik, Fundamentals and technology of combustion, Elsevier