



Course Syllabus: Experimental Combustion - ME 378

Division	Physical Science and Engineering Division
Course Number	ME 378
Course Title	Experimental Combustion
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	10:30 AM - 12:00 PM Sun Tue

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Min Suk Cha	min.cha@kaust.edu.sa	+966128082709	4218, 5, Al-Kindi (bldg. 5)	Tue 16:00 - 17:00

Teaching Assistant(s)	
Name	Email

Course Information	
Comprehensive Course Description	<p>Instruction of experimental approaches to study flames and combustion is a main focus of this course. This course is designed for students conducting experiments to facilitate practical realizations of their experiments in knowledge and design base. However, because this course is also designed to teach fundamental aspects of premixed flames and nonpremixed flames via experimental parametric studies, it would be greatly helpful for students performing numerical simulations by filling a gap between their codes and real flames of interests. Diagnostic methods to measure species and flow field are also instructed. Intended subject areas are as follows:</p> <ul style="list-style-type: none"> -Widely used fundamental burners: coflow burner, counterflow burner, constant volume combustion chamber, flat flame burner -Laminar premixed flames -Laminar nonpremixed flames -Jet flames -Edge flames <p>Diagnostic methods: laser induced fluorescence, laser induced incandescence, and particle image velocimetry.</p>
Course Description from Program Guide	<p>Experimental methods for combustion study will be instructed. Widely studied canonical flames and burners, which include a coflow burner, a counterflow burner, jet flames, and outwardly propagating flames, will be introduced and detailed experimental conditions to control various flame characteristics, such as flame temperature and burning velocity, will be instructed. Practical diagnostic methods such as laser induced fluorescence and particle image velocimetry will be covered. Complementary experiments will be provided for practical knowledge and experience.</p>
Goals and Objectives	<ul style="list-style-type: none"> -Understanding practical knowledge how to realize combustion experiment -Obtaining fundamental knowledge and experience of various flames with canonical burners -Acquiring diagnostic methods for major combustion properties

Required Knowledge	<ul style="list-style-type: none"> -General mechanical engineering background -Physics and chemistry in combustion -Basic knowledge of laser and optics
Reference Texts	<ul style="list-style-type: none"> -Combustion Physics, C. K. Law -Selected research articles will be studied
Method of evaluation	<p>30.00% - Final exam 50.00% - Course Project(s) 20.00% - Attendance and Participation</p>
Nature of the assignments	Experimental mini-projects and written reports
Course Policies	<p>Absence without prior notice will not be accepted. Late submission of assignments will not be accepted.</p>
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 08/25/2019	Semester starts/ Introduction
1	Tue 08/27/2019	Tips for successful research/ Photography
2	Sun 09/01/2019	Flow metering principles and flow meters
2	Tue 09/03/2019	Lab: MFC calibration
3	Sun 09/08/2019	Basic concept of combustion: chemical reaction and heat release
3	Tue 09/10/2019	Basic concept of combustion: Deflagration and Detonation
4	Sun 09/15/2019	Premixed flames: general concepts
4	Tue 09/17/2019	Premixed flames: estimation of laminar burning velocity
5	Sun 09/22/2019	University holiday
5	Tue 09/24/2019	Lab: premixed laminar jet flames
6	Sun 09/29/2019	Lab: premixed laminar jet flames
6	Tue 10/01/2019	Diffusion flames: general concepts
7	Sun 10/06/2019	Diffusion flames: jet and counterflow
7	Tue 10/08/2019	Lab: non-premixed jet flames
8	Sun 10/13/2019	Lab: non-premixed jet flames
8	Tue 10/15/2019	Lab: non-premixed counterflow flames
9	Sun 10/20/2019	Lab: non-premixed counterflow flames
9	Tue 10/22/2019	Lab: premixed counterflow flames
10	Sun 10/27/2019	Mid-semester break
10	Tue 10/29/2019	Mid-semester break
11	Sun 11/03/2019	Lab: premixed counterflow flames
11	Tue 11/05/2019	Combustion diagnostics
12	Sun 11/10/2019	Lab: flow visualization
12	Tue 11/12/2019	Lab: flow visualization
13	Sun 11/17/2019	Lab: PIV measurement
13	Tue 11/19/2019	Lab: PIV measurement
14	Sun 11/24/2019	Lab: PLIF measurement of OH radical in premixed flames
14	Tue 11/26/2019	Lab: PLIF measurement of OH radical in premixed flames
15	Sun 12/01/2019	Edge flames: fundamentals
15	Tue 12/03/2019	Lab: lifted flame experiment
16	Sun 12/08/2019	Exams
16	Tue 12/10/2019	Exams

Note

The instructor reserves the right to make changes to this syllabus as necessary.