Syllabus of CCUME, Academic Year 2022, 1st Semester

Course Name： (Chinese) 大氣電漿技術應用與檢測 (English) Applications and Characterization of Atmospheric-Pressure Plasma Discharges					Course Department	AIM-HI
					Course Code	4456270
Instructor	Lin, Kun-Mo	Credit	3	☐Required Course ■Elective Course	**Target Students**	Senior, Master/Ph.D
Prerequisite(s)：Fundamental Physics, Engineering Mathematics						

Course Description:

Atmospheric pressure plasma discharges have been used extensively in applications such as combustion, pollution control, and active flow control. This course is designed to introduce the importance of plasma discharges in applications and diagnostics applied to characterize discharge properties. To understand discharge behavior, it is essential to conduct both experimental measurements and numerical simulations. The topics introduced in this course include different applications, details of ultraviolet absorption spectroscopy (one of the methods for measuring species density), and a plasma fluid model for understanding discharge fundamentals.

Objectives:

To ensure students understand

1. The importance of plasmas in different applications.
2. The experimental method applied to measure species density.
3. The numerical model used to predict the discharge behavior.

References	1. P. K. Chu, and X. P. Lu, "Low Temperature Plasma Technology-Methods and Applications," 1st ed., Taylor & Francis Group, 2014. 2. A. Grill, "Cold Plasma in Materials Fabrication," 1st ed., Wiley-IEEE Press, 1994.

Course Outline		**Hours**				**Achievable Core Competence of Course**
Topic	**Contents**	**Lecture**	**Demonstration**	**Assignments**	**Other**	
Introduction	1. Plasma fundamentals 2. Plasma classifications	3				D1, D2, D8
Applications	1. Plasma-assisted combustion 2. Pollution control	9		6		D1, D2, D8
Plasma Fluid Model	1. Simulation basics 2. Governing equations 3. Chemistry of air discharges 4. Chemistry of He discharges 5. Virtual probes	12	3			D1, D2, D8
Plasma Diagnostics	1. Measurements of electric properties 2. Optical emission spectroscopy 3. Ultraviolet absorption spectroscopy	9				D1, D2, D8
Case Study	1. He discharge	3		6		D1, D2, D8

Achievable Core Competence of Course		Achievable Indicators of Core Competence
D1	Well established advanced knowledge in mechanical engineering	
D2	Competence in planning and conducting research and development projects in mechanical engineering and related disciplines	
D8	Engagement to lifelong learning	

Notes:				
Location	**Location**	**Location**	Office hour	**Assessment of Teaching quality**
Wed: 09:10-12:00	ME 214(R)	Homework: 20% Midterm report: 30% Final report: 40% Interactivity: 10%	Tue:10:00-12:00	1.Student Evaluation of Teaching 2 Questionnaire on the Level of Achievement of Core Competence
Week	**Subject & Homework**			**Remarks**
1	Introduction of plasma fundamentals – discharge parameters			
2	Introduction of plasma fundamentals – discharge behavior			
3	Application – Combustion I			HW-1
4	Application – Combustion II			
5	Application – Pollution control I			
6	Application – Pollution control II			HW-2
7	Diagnostics – UVAS (ozone) I			
8	Diagnostics – UVAS (ozone) II			
9	Simulation – Plasma fluid model I			
10	Simulation – Plasma fluid model II			HW-3
11	Simulation – Chemistry of helium discharges			
12	Simulation – Chemistry of air discharges			
13	Transport properties of electrons, ions, and neutrals			
14	Simulation – Work with the program of plasma fluid model			
15	Case study – Work with virtual probes I - Parameters			

16	Case study – Work with virtual probes II (Output format)	
17	Case study – Discharge analysis	
18	Final report (Case study)	
Others:		