Syllabus of CCUME, Academic Year 2025, 1st Semester

<table>
<tr><td colspan="5">Course Name：
(Chinese) 大氣電漿技術應用與檢測
(English) Applications and Characterization of Atmospheric-Pressure Plasma Discharges</td><td>Course Department</td><td>Mechanical Engineering</td></tr>
<tr><td colspan="5"></td><td>Course Code</td><td>4205564</td></tr>
<tr><td>Instructor</td><td>Lin, Kun-Mo</td><td>Credit</td><td>3</td><td>☐Required Course
■Elective Course</td><td>Target Students</td><td>Senior, Master/Ph.D</td></tr>
<tr><td>全英文授課
EMI</td><td colspan="6">■是 ☐否</td></tr>
<tr><td colspan="7">Prerequisite(s)：Fundamental Physics, Engineering Mathematics</td></tr>
<tr><td colspan="7">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.</td></tr>
<tr><td>References</td><td colspan="6">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.
「請尊重智慧財產權，不得非法影印教師指定之教科書籍」</td></tr>
<tr><td colspan="7">教學要點概述</td></tr>
<tr><td>教材編選
teaching materials</td><td colspan="6">■ 自製簡報(ppt) ☐課程講義 ☐自編教科書
☐ 教學程式 ☐自製教學影片 ☐其他</td></tr>
<tr><td>教學方法
teaching methods</td><td colspan="6">■講述 ■小組討論 ■學生口頭報告 ■問題導向學習
☐個案研究 ☐其他</td></tr>
<tr><td>評量工具
Evaluation tools</td><td colspan="6">☐期中考 ☐期末考 ☐隨堂測驗 ■隨堂作業
☐課後作業 ☐期中報告 ☐期末報告 ■專題報告
☐評量尺規 ☐其他</td></tr>
<tr><td>教學資源
teaching resources</td><td colspan="6">☐課程網站 ■教材電子檔供下載 ☐實習網站</td></tr>
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教師相關訊息 instructor's information	

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 433	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:		