Subject Description Form

Subject Code	ME6401
Subject Title	Combustion Science
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	N.A.
Objectives	1. To provide fundamental scientific aspects of combustion. 2. To develop sound understanding of relationships among fuels, combustion processes and pollutant emissions. 3. To develop knowledge for the evaluation of combustion, thermal and emission characteristics of a combustion process.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the combustion process between fuels and oxygen, and different types of flame. b. Apply Thermodynamics to solve the energy conversion of a combustion process. c. Apply Chemical Kinetics of Combustion to evaluate the chemical reaction of a combustion process. d. Evaluate the air pollutants formed and emitted during a combustion process. e. Understand the most current trend in combustion science with the main goal to protect the environment.
Subject Synopsis/ Indicative Syllabus	***Fundamentals of Combustion Science*** **-** nature of combustion; premixed and diffusion flames; laminar and turbulent flames; fuel-lean, stoichiometric and fuel-rich combustion; flame stability and flammable limits; open-flame and impingement heat transfer. ***Fuels and Combustion*** **-** gaseous, liquid and solid fuels; fuel properties; air pollutants formed during combustion process; alternative fuels. ***Thermodynamics of Combustion*** **-** combustion stoichiometry; chemical equilibrium and equations; Laws of Thermodynamics applying to combustion process; enthalpy of combustion; Adiabatic flame temperature; calorific value. ***Chemical Kinetics of Combustion*** **-** elementary reactions; chain and global reactions; nitrogen oxide kinetics; soot kinetics; dissociation and equilibrium constants. ***Combustion-led Air Pollution*** **-** carbon oxides and hydrocarbons; sulfur oxides; nitrogen oxides; particulates and soot. ***Current Trend in Combustion for Environmental Protection*** **-** sulfur-free liquid fuels; low-NO_X combustion; bio-fuels; hydrogen; hydrocarbon gaseous fuels enriched with hydrogen.

Teaching/Learning Methodology

Lectures are used to deliver fundamental knowledge in various scientific aspects of combustion.

Seminars are provided by Guest Speakers on most current development in combustion science for the purpose of environmental protection.

Tutorials are used to demonstrate the applications of fundamental knowledge of combustion science.

Laboratory works are used to enhance the understanding of relationships among fuels, combustion processes and pollutant emissions, and provide hands-on experience for their evaluations.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Laboratory Report	15%	√	√	√	√	√
2. Mini Project Report	15%	√			√	√
3. Test	20%	√	√	√	√	√
4. Examination	50%	√	√	√	√	√
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment: 0.5 (Examination) + 0.5 (Continuous Assessment)
Continuous Assessment: Laboratory Report + Mini Project Report + Test

Laboratory report will be used to assess the students' understanding of relationships among fuels, combustion processes and pollutant emissions, and their ability to evaluate a combustion process.

Mini project report will be used to assess the students' understanding of relationships among fuels, combustion processes and pollutant emissions, and their ability to explore the most current development in combustion science.

Test and examination will be used to assess the students' overall understanding of the subject and their ability to apply fundamental knowledge at the middle and end of the semester.

Student Study Effort Expected	Class contact:	
	▪ Lectures and Seminars	33 Hrs.
	▪ Tutorials and Laboratory Works	6 Hrs.
	Other student study effort:	
	▪ Mini-project and Laboratory Reports	20 Hrs.
	▪ Assignments	20 Hrs.
	▪ Literature Review and Self-learning	33 Hrs.
	Student study effort expected	112 Hrs.

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