Subject Description Form

Subject Code	ME5203
Subject Title	Green Combustion
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Students should have basic knowledge in Thermodynamics.
Objectives	1. To provide knowledge about the state-of-the-art green combustion technologies; the basics of thermodynamics and chemical kinetics in green combustion; the fundamentals of various ideal reactors to investigate chemical kinetics in combustion; the modelling of ideal reactors; and the computation of thermochemical and kinetic parameters. 2. To provide hands-on training on kinetic combustion modelling and quantum chemistry computation.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. contribute to their professional competence in the area of green combustion, from both fundamental and practical perspectives; b. provide solutions for real combustion problems from molecular level to practical applications; c. have recognition of the need for, and an ability to engage in life-long learning.
Subject Synopsis/ Indicative Syllabus	**Green combustion technologies**: review of combustion pollutants and their environmental impact; green combustion strategies and green fuels to mitigate combustion environmental effects **Thermodynamics and chemical kinetics in green combustion**: collision theory; reaction theory; reaction rate order and reaction rates; chemical thermodynamics and equilibrium; simple and complex kinetic systems **Ideal reactors**: constant volume closed reactors; perfectly-stirred reactors; plug-flow reactors; governing equations and conservation laws; experimental set-up and control; advantages and limitations **Modelling of ideal reactors**: chemical kinetic effects; thermodynamic effects; transport effects; modelling software review **Computation of thermochemical and kinetic parameters**: statistical mechanics and molecular dynamics; electronic structure theory; group additivity; transition state theory and semi-classical treatments; master equation; modelling software review

Teaching/Learning Methodology	1. The teaching and learning methods include lectures/tutorial/laboratory sessions, homework assignments, test, case study report and examination. 2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for green combustion applications. 3. Technical/practical examples and problems are raised and discussed in class/tutorial sessions.

Specific assessment methods/tasks	Intended subject learning outcomes		
	a	b	c
1. Lecture	√	√	√
2. Tutorial/Laboratory	√	√	√
3. Homework assignment	√	√	√
4. Case study report and presentation	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Homework assignment	20%	√	√	√
2. Test	20%	√	√	
3. Case study report and presentation	20%	√	√	√
4. Examination	40%	√	√	√
Total	100 %			

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

Overall Assessment:

0.40 × End of Subject Examination + 0.60 × Continuous Assessment

The continuous assessment consists of three components: homework assignments, test, and case study report & presentation. They are aimed at evaluating the progress of student study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.

The examination is used to assess the knowledge acquired by the students for understanding and analysing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture	24 Hrs.
	▪ Tutorial/Case study/Laboratory	15 Hrs.
	Other student study effort:	
	▪ Self-study	55 Hrs.
	▪ Case study report preparation and presentation	21 Hrs.
	Total student study effort	115 Hrs.
Reading List and References	<u>Books:</u> 1. Battin-Leclerc, F., Simmie, J. M., & Blurock, E. *Cleaner Combustion*, Springer International Publishing AG, latest edition. 2. Wright, M. R. *Introduction to Chemical Kinetics*. John Wiley & Sons, latest edition. 3. Lee, S., Speight, J. G., & Loyalka, S. K. (Eds.). *Handbook of Alternative Fuel Technologies*. CRC Press, latest edition. 4. Kauzmann, W. *Quantum Chemistry: An Introduction*. Elsevier, latest edition. 5. Turns S. R., *An Introduction to Combustion: Concepts and Applications*, McGraw-Hill, latest edition. <u>Journals:</u> 1. Combustion and Flame 2. Proceedings of the Combustion Institute 3. International Journal of Chemical Kinetics 4. Energy 5. Fuel 6. Energy & Fuels 7. Physical Chemistry Chemical Physics	

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