Subject Description Form

Subject Code	ME5207
Subject Title	Electrochemical Energy Conversion Materials and Devices
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Basic knowledge in mechanical engineering or chemical Engineering or electrical engineering or material engineering.
Objectives	To provide students with knowledge of electrochemical energy storage devices and their functional materials
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. have the knowledge of the electrochemical fundamentals, electrochemical energy conversion material, electrochemical energy conversion devices (batteries and capacitors) and their management. b. understand the current trend of the battery and capacitor research and development areas. c. have recognition of the need for, and an ability to engage in life-long learning.
Subject Synopsis/ Indicative Syllabus	***Electrochemistry basics:*** electrochemical reactions; electrochemical thermodynamics; introduction to kinetics ***Electrochemical batteries and materials:*** working principles; battery classification; battery materials; characterization techniques; current development trend. ***Electrochemical capacitor and materials:*** working principles; capacitor materials; characterization; and current development trend. ***Battery development and management:*** typical battery development process from material to electrode, cell, pack, and battery; introduction to control and management.

Teaching/Learning Methodology

1. The teaching and learning methods include lectures/tutorials, homework assignments, test, case study presentation and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for electrochemical batteries and capacitors.
3. Technical/practical examples and problems will be raised and discussed in class/tutorial sessions.

Teaching/Learning methodology	Intended subject learning outcomes		
	a	b	c
1. Lecture	✓	✓	✓
2. Tutorial	✓	✓	
3. Homework assignments/test/examination	✓	✓	
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		
		a	b	c
1. Homework assignment	15%	✓	✓	
2. Test	20%	✓	✓	
3. Case study report and presentation	15%	✓	✓	✓
4. Examination	50%	✓	✓	
Total	100 %			

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

Overall Assessment:

0.50 x End of Subject Examination + 0.50 x 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 students' 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 analyzing 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	15 Hrs.
	Other student study effort:	
	▪ Self-study	45 Hrs.
	▪ Case study preparation and presentation	21 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	**Textbooks:** Cornelia Breitkopf, Karen Swider-Lyons, Handbook of Electrochemical Energy, Springer, 2017 J.-M. Tarascon and P. Simon, Electrochemical Energy Storage, Wiley, 2015 S. Passerini, D. Bresser, A. Morretti, and A. Varzi, Batteries, Willey-VCH, 2020 S. Kumugai and D. Tashima, Electrochemical Capacitors, MDPI, 2020 M. K. Gulbinska, Lithium-ion Battery Materials and Engineering, Springer, latest version J. T. Warner, The handbook of lithium-ion battery pack design, Elsevier, latest version G. Plett, Battery Management Systems: Volume 1, Battery Modelling, Artech, latest version K. Kanamura, Next Generation Batteries, Springer, 2021 **Journals:** Nature Energy, Nature Publishing Group. Journal of Power Sources, Elsevier Science Ltd. Journal of Electrochemical Society, Electrochemical Society. Electrochimica Acta, Elsevier Science Ltd.	

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