Subject Description Form

Subject Code	ME5202
Subject Title	Solar and Wind Engineering
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To understand the importance and global trend of solar and wind energy in solving the energy and environmental problems we are facing. 2. To provide students with fundamental knowledge of solar and wind resources, energy conversion principles, solar and wind system designs and operations. 3. To enable students to design and analyze solar and wind energy systems, and corresponding hybrid systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) understand the concepts and components of solar and wind resources and systems; b) apply the fundamental knowledge of solar and wind engineering for applications and innovations; c) design and evaluate different types of solar and wind energy systems; d) obtain comprehensive knowledge and skills on selected topics in solar and wind engineering. e) have recognition of the need for, and an ability to engage in life-long learning.
Subject Synopsis/ Indicative Syllabus	***Introduction***: renewable energy resources; global trend; solar and wind technologies; environmental impact; overview of related heat and mass transfer topics. ***Wind Energy:*** wind characteristics; extraction characteristics; wind turbines; wind farm aerodynamics; power generation; on-shore and off-shore wind farms. ***Solar Energy:*** solar radiation; radiation characteristics of materials; photovoltaic applications; solar thermal applications. ***Energy Storage:*** sensible and latent heat storage; chemical energy storage; battery storage; hydroelectric and compressed air. ***Grid Planning and Operations:*** renewable power integration into power grid and its related issues; micro grid; smart grid; power dispatching; distributed generation and automation system. ***Solar and Wind Forecasting:*** impact of solar and wind forecasting on grid management; forecasting basics; physical and data - driven forecasting methodologies.

Teaching/Learning Methodology

1. The teaching and learning methods include lectures sessions, homework assignments, project, site visit and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for solar and wind engineering.
3. Technical/practical examples and problems will be raised and discussed in lecture sessions.
4. A team project with report and presentation will be used to enhance students' understanding of the subject contents and practice presentation skills.
5. A site visit to a solar and wind farm will further provide an opportunity for students to understand the various components of a commercial solar and wind system as well as the operations of such system.

Teaching/Learning Methodology	Intended subject learning outcomes				
	a	b	c	d	e
1. Lectures	✓	✓	✓	✓	✓
2. Homework assignment	✓	✓	✓		
3. Project report and presentation				✓	✓
4. Site visit				✓	

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. Homework	15%	✓	✓	✓		
2. Project	20%				✓	✓
3. Test	15%	✓	✓	✓		
4. Examination	50%	✓	✓	✓		
Total	100 %					

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

Overall Assessment:

0.50 × Examination + 0.50 × Continuous Assessment

1. The continuous assessment will comprise two components: team project (20%), test (15%) and homework (15%). The team project, test and homework are aimed at evaluating their understandings on solar and wind systems and enhancing the integration of their knowledge learnt.
2. The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analysing the problems critically and independently, and to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture	36 Hrs.
	▪ Tutorial/Presentation	3 Hrs.
	Other student study effort:	
	▪ Project/Assignments	40 Hrs.
	▪ Self-study	25 Hrs.
	▪ Site visit	6 Hrs.
	Total student study effort	110 Hrs.
Reading List and References	Duffie J.A. and Beckman W.A., *Solar Engineering of Thermal Processes, Photovoltaics and Wind*, Wiley, latest edition. Rosa A.V. and Ordonez J.C., *Fundamentals of Renewable Energy Processes*, Elsevier Science, latest edition. Petela R., *Engineering Thermodynamics of Thermal Radiation: for Solar Power Utilization*, McGraw Hill, latest edition. Smets A. H., Jäger K., Isabella O., Swaaij, R. A. and Zeman M., *Solar Energy: The Physics and Engineering of Photovoltaic Conversion, Technologies and Systems*, UIT Cambridge Ltd., latest edition. Nelson V. and Starcher K., *Introduction to Renewable Energy*, CRC Press, Taylor & Francis Group, latest edition. Letcher T.M., *Wind Energy Engineering: A Handbook for Onshore and Offshore Wind Turbines*. Academic Press, latest edition. Agarwal P., Mittal M., Ahmed J. and Idrees S.M., *Smart Technologies for Energy and Environmental Sustainability*. Springer, latest edition. <u>Journals:</u> 1. Solar Energy, Elsevier Science Ltd. 2. Renewable Energy, Elsevier Science Ltd. 3. Energy, Elsevier Science Ltd. 4. Renewable and Sustainable Energy Reviews, Elsevier Science Ltd. 5. Journal of Renewable and Sustainable Energy, AIP Publishing Ltd.	

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