Subject Description Form

Subject Code	BSE545
Subject Title	Applied Solar Energy in Buildings
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	a. To provide students with an overall view of solar energy application in buildings, particularly of applied solar energy technologies. b. To enable students to understand the theory, design and operation and maintenance of solar energy systems. c. To enable students to test and analyze the energy performance of solar energy equipment and systems. d. To equip students with the ability to do economic and environment impact analysis of solar energy projects.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. use the fundamentals of the subject for designing main solar energy systems for use in buildings; b. analyze the energy, economic and environmental performance of main solar energy application systems; c. apply the basic knowledge for promoting solar energy application technologies for use in buildings.
Subject Synopsis/ Indicative Syllabus	**Solar energy resource:** solar constant, spectrum of the Sun, solar radiation, direct and diffuse solar radiation, available solar radiation, solar radiation data conversion for different inclinations, solar radiation measurements and typical meteorological years. **Passive solar thermal applications:** passive solar space heating, hot air space heating, gas-absorption cooling, evaporative cooling, shading effect, overhangs, wingwalls, energy storage, hybrid passive and active thermal systems. **Active solar thermal energy applications:** solar collector heating systems for hot water production, types of solar collectors, sizing of solar thermal energy systems, optimization of solar collector heating systems and annual energy simulation. **Solar electrical generation:** photovoltaic conversion, solar cells, photovoltaic modules, inverters, PV characteristics, stand-alone PV systems, grid-connected PV systems, control, maximum power point trackers, design procedures and energy performance analysis. **Building-integrated photovoltaics:** PV-walls, PV-roofs, PV claddings, PV architecture integration, design concept, design guidelines, system sizing, component selection, installation and maintenance.

<table>
<tr><td></td><td>Hybrid solar-wind power generation: wind power resource, potential analysis, probability and reliability analysis, complementary characteristics, system design optimization, system control, operation and maintenance.

Energy economic and environmental impact analysis: solar energy cost, capital investment, operation and maintenance cost, life-cycle analysis, environmental impacts, and greenhouse gas emissions.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The realisation of the subject objectives will be primarily on the basis of lectures and student seminars under adequate guidance from subject lecturers. Appropriate arrangement for tutorials will be made to give sufficient guidelines for students to prepare seminar presentation and reports. Two workshops/lab measurements/site visits will be organized to enhance the studies. Students will also be directed to complete a self reading programme to enhance understanding of the subject contents. Tutorial work will mainly focus on helping students prepare seminar reports and understand general problems related to the subjects.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a.</td><td>b.</td><td>c.</td><td></td><td></td><td></td></tr>
<tr><td>1. Examination</td><td>60%</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>2. Coursework</td><td>40%</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The basic principles and theory of the taught topics are assessed in the examination so that we make sure that students really learn them for future system design and analysis of main solar energy systems in buildings. The course work assessment is designed to enhance the studies to help students to learn the topics. Therefore, all the three outcomes are assessed in both the examination and coursework.</td></tr>
<tr><td>Reading List and References</td><td><u>Indicative reading list and references:</u>

Deo, P. & Mark, S. (2005). Designing with Solar Power, Earthscan, Australia.

Duffie, J. A. & William, A.B., (1991). Solar Engineering of Thermal Process, John Willey & Sons, Inc.

Jeffrey, G. (2001). Solar Energy: The State of The Art, James & James (Science Publishers) Ltd., London, UK.

Journals (International Journal of): Solar Energy; Solar Energy Engineering; Renewable Energy; Energy Research; Applied Energy; Green Energy.

Partain, L.D. (1995). Solar Cells and Their Applications, John Wiley & Sons, Inc., New York.

Robert Foster, Majid Ghassemi and Alma Cota (2010). Solar Energy-</td></tr>
</table>

	Renewable Energy and the Environment, CRC Press, New York. Sick, F. & Thomas, E. (1996). *Photovoltaics in Buildings*, James and James (Science Publishers) Ltd., London. Steven Winter Associates (1998). *Passive Solar Design And Construction Handbook*, New York, Wiley. Strong, S.J. & William, G.S. (1993). *The Solar Electric House*, Sustainability Press, Massachusetts. Twidell, J. & Wein, T. (1986). *Renewable Energy Resources*, Cambridge University Press. Wortman, A.J. (1983). *Introduction to Wind Turbine Engineering*, Butterworth Publishers, Boston. Yan, Jinyue (2015). Handbook of Clean Energy Systems, John Wiley & Sons Ltd., London. 楊洪興，呂琳，馬濤：太陽能-風能互補發電技術及應用。中國建築工業出版社，ISBN 978-7-112-17328-0，2015 年 1 月第一次印刷。 楊洪興，呂琳，彭晉卿，周偉：太陽能建築一體化技術與應用。北京：中國建築工業出版社，ISBN 978-7-112-18286-2，2015年10月第二版，2015年第八次印刷。 楊洪興, 薑希猛編著：《綠色建築發展與可再生能源應用》，中國鐵道出版社，47萬字，ISBN 978-7-113-21689-4，2016年12月第一版。