The Hong Kong Polytechnic University

Subject Description Form

Please read the notes at the end of the table carefully before completing the form.

Subject Code	AP40011
Subject Title	Materials in Energy Conversion and Storage
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	NIL
Objectives	To introduce the basic concepts, physical/chemical principles and key materials applied in the latest technologies for energy conversion and storage processes, with focuses of developing a comprehensive understanding of materials used for energy conversion and storage devices.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: a) understand, in a broad context, the basic knowledge of energy sustainability and various kinds of energy conversion and storage processes; b) understand the basic physical/chemical principles behind various kinds of energy conversion and storage devices; and c) have a thorough understanding on the materials issues of the energy conversion and storage devices.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	**Energy Resources** : Energy landscape, Sustainability, Energy challenges **Energy Conversion and Materials :** Thermoelectric conversion, Mechanoelectric conversion, Nuclear energy conversion, Fuel cells, Other types of energy conversion **Energy Storage and Materials :** Electrochemical storage in batteries, supercapacitors, parallel plate, Hydrogen storage
Teaching/Learning Methodology *(Note 3)*	**Lecture**: The working principles and materials issues of various kinds of energy conversion and storage processes will be explained, with particular emphasis on the latest applications, such as thermoelectrics, fuel cells, batteries and supercapacitors. Examples will be used to illustrate the concepts and basic physical/chemical principles related to the energy conversion and storage processes delivered in the lecture. **Tutorial:** Students will work on a prescribed set of problems in tutorials. They are encouraged to solve problems and to use their own knowledge

<table>
<tr><td></td><td>to verify their solutions before seeking assistance. These problem sets provide them opportunities to apply their knowledge gained from the lecture. They also help the students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes

(Note 4)</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. Continuous assessment</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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Continuous assessment:
The continuous assessment includes assignments and mid-term test which aim at checking the progress of student study throughout the course, assisting them in fulfilling the learning outcomes.
Assignments, in general, are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.
One mid-term test will be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended learning outcomes, and as a means of checking how effective the students digest and consolidate the materials taught in the class.

Examination: This is a major assessment component of the subject. It is a closed-book examination. The emphasis of assessment is to test the understanding, analysis and problem solving ability of the students.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures</td><td>33 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>6 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study</td><td>81 Hrs.</td></tr>
<tr><td>▪</td><td>Hrs.</td></tr>
<tr><td>Total student study effort</td><td>120 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>

Kathy Lu, Materials in Energy Conversion, Harvesting and Storage, John Wiley & Sons, 2014.
Ru-Shi Liu et al., Electrochemical Technologies for Energy Storage and Conversion, Wiley-VCH Verlag & Co. KGaA, 2012.
F. Béguin and E. Frackowiak, Supercapacitors, Wiley-VCH Verlag

</td></tr>
</table>

	& Co. KGaA, 2013. • Robert A. Huggins, **Energy Storage**, Springer, 2010. • Andrzej Lasia, **Electrochemical Impedance Spectroscopy and its Applications**, Springer, 2014.

Note 1: Intended Learning Outcomes
Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/Indicative Syllabus
The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology
This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method
This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.