

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	AP30015
Subject Title	Functional Materials
Credit Value	3
Level	3
Pre-requisite	AP20002 Materials Science
Objectives	The objectives of this subject are to provide students with an overview of functional materials, an understanding of their structures and properties, with the emphases on their inter-relationships, and a general description of their applications.
Intended Learning Outcomes (Note 1)	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) recognize the board range of current and future important types of functional materials; (b) outline the important properties of various functional materials; (c) relate phase transition and structural symmetry to the different functional properties covered; (d) describe microscopic mechanisms for ferroelectricity, ferromagnetism, in addition to related dielectric and magnetic properties; (e) describe microscopic mechanisms for optical properties and their relations to structural and other properties; (f) understand the physical principles underlying the piezoelectric, electrostrictive and magnetostrictive effects; and (g) describe the typical processing and applications for functional materials.
Subject Synopsis/ Indicative Syllabus (Note 2)	<p>Types of materials: General classification: metal, ceramics, polymers, composites; functional materials such as dielectric, magnetic materials, smart materials such as shape memory, ferroelectric, ferromagnetic, piezoelectric, electrostrictive and magnetostrictive materials.</p> <p>Properties of functional materials: brief revision of basic properties such as electrical conduction, mechanical and thermal properties; different phases of materials, dielectric, magnetic, ferroelectric, ferromagnetic and optical properties, coupling effects such as piezoelectric, electrostrictive and magnetostrictive effect.</p> <p>Processing of function materials: typical processing techniques for functional materials.</p> <p>Applications of functional materials: actuation, sensing, light detection, etc.</p>

<p>Teaching/Learning Methodology</p> <p>(Note 3)</p>	<p>Lecture: The concepts related to functional materials and their important properties will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. Students are free to request help. Assignment sets will be given to assess the learning progress of students.</p> <p>Tutorial: Students will work on a prescribed set of problem in the tutorials. They are encouraged to solve problems and to use their own knowledge 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.</p>																																																			
<p>Assessment Methods in Alignment with Intended Learning Outcomes</p> <p>(Note 4)</p>	<table border="1" data-bbox="520 678 1474 1093"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="7">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th>f</th> <th>g</th> </tr> </thead> <tbody> <tr> <td>1. Continuous assessment</td> <td>40</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>2. Examination</td> <td>60</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Total</td> <td>100 %</td> <td colspan="7"></td> </tr> </tbody> </table> <p>Continuous assessment: The continuous assessment includes assignments and mid-term test(s) 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. Mid-term test(s) 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.</p> <p>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.</p>									Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)							a	b	c	d	e	f	g	1. Continuous assessment	40	✓	✓	✓	✓	✓	✓	✓	2. Examination	60	✓	✓	✓	✓	✓	✓	✓	Total	100 %							
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Reading List and References	<ol style="list-style-type: none"> 1. Deborah D.L. Chung, Functional Materials: Electrical, Dielectric, Electromagnetic, Optical and Magnetic Applications, World Scientific 2010. 2. William F. Smith, Javad Hashemi, Foundations of Materials Science and Engineering, Mc Graw Hill Education, 2009.
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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.