**City University of Hong Kong**
**Course Syllabus**

**offered by Department of Physics**
**with effect from Semester B 2017/18**

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**Part I Course Overview**

| | |
|---|---|
| **Course Title:** | **Nanomaterials** |
| **Course Code**: | **AP8302** |
| **Course Duration:** | **One Semester** |
| **Credit Units**: | **3** |
| **Level**: | **R8** |
| **Proposed Area:** *(for GE courses only)* | ☐ Arts and Humanities<br>☐ Study of Societies, Social and Business Organisations<br>☐ Science and Technology |
| **Medium of Instruction:** | **English** |
| **Medium of Assessment:** | **English** |
| **Prerequisites**: *(Course Code and Title)* | **Nil** |
| **Precursors**: *(Course Code and Title)* | **Nil** |
| **Equivalent Courses**: *(Course Code and Title)* | **Nil** |
| **Exclusive Courses**: *(Course Code and Title)* | **AP5302 Nanomaterials** |

## Part II Course Details

### 1. Abstract

This course will enable students to appreciate and recognize the difference in physical properties of nanomaterials as compared to their bulk counterparts. It will provide students with the knowledge on physical properties, major classes, synthesis and processing, characterisation techniques and selected applications of nanomaterials.

### 2. Course Intended Learning Outcomes (CILOs)

| No. | CILOs | Weighting* (if applicable) | Discovery-enriched curriculum related learning outcomes (please tick where appropriate) | | |
|---|---|---|---|---|---|
| | | | *A1* | *A2* | *A3* |
| 1. | Recognize and explain the differences in physical properties of nanomaterials as compared to the bulk counterparts | | | √ | |
| 2. | Understand and apply methodologies and techniques of synthesis, processing and characterization of major classes of nanomaterials | | √ | | |
| 3. | Recognize major application areas of nanomaterials and be able to generate creative solutions for different applications | | | | √ |
| 4. | Demonstrate the capacity for self-directed learning on topics related to the design, use and research of nanomaterials in the contemporary world | | √ | √ | |
| | | 100% | | | |

** If weighting is assigned to CILOs, they should add up to 100%.*

*# Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.*

*A1: Attitude*
*Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.*

*A2: Ability*
*Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.*

A3: *Accomplishments*
*Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.*

## 3. Teaching and Learning Activities (TLAs)

| TLA | Brief Description | CILO No. | | | | | | Hours/week (if applicable) |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | | | |
| Lecture | Understand key concepts and engage in inquiry | √ | √ | √ | √ | | | 2 hrs/wk |
| Tutorial activity | Demonstrate the capability of analysis and critical thinking; appreciate the essence of research | √ | √ | √ | √ | | | 1 hrs/wk |
| Homework | Analyse creative works, including original research publications, and generate work with new concepts | √ | √ | | √ | | | 0.5 hrs/wk |

## 4. Assessment Tasks/Activities (ATs)

| Assessment Tasks/Activities | CILO No. | | | | | | Weighting* | Remarks |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | | | |
| Continuous Assessment: 20% | | | | | | | | |
| Active class participation | √ | √ | √ | √ | | | 5% | |
| Discussion at tutorial | √ | √ | √ | | | | 5% | |
| Quiz and homework essay | √ | √ | | √ | | | 10% | |
| Examination: 80% (duration: 2 hrs) | | | | | | | | |
| ** The weightings should add up to 100%.* | | | | | | | 100% | |

## 5. Assessment Rubrics

| Assessment Task | Criterion | Excellent (A+, A, A-) | Good (B+, B, B-) | Fair (C+, C, C-) | Marginal (D) | Failure (F) |
|---|---|---|---|---|---|---|
| 1. Discussion at tutorial | CAPACITY for SELF-DIRECTED LEARNING to understand the principles | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 2. Quiz | ABILITY to EXPLAIN methodologies | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 3. Homework essay | ABILITY to GENERATE new concepts | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 4. Final examination | AlLL above | High | Significant | Moderate | Basic | Not even reaching marginal levels |

**Part III Other Information** (more details can be provided separately in the teaching plan)

**1. Keyword Syllabus**

- **Physical properties of nanomaterials as compared to the bulk counterparts**
  Electronic structure of solids, electrical, magnetic, optical properties

- **Major classes of nanomaterials**
  Semiconductor quantum dots, metal nanoparticles, 1D nanomaterials, carbon-based nanomaterials, coatings and thin films

- **Synthesis and processing technologies of nanomaterials**
  Top-down and bottom-up approach, lithography, physical vapour deposition, chemical vapour deposition, colloidal synthesis, assembly and self-assembly

- **Characterisation methods of nanomaterials**
  Structure analysis: microscopy methods, diffraction methods; optical spectroscopy based methods

- **Application areas of nanomaterials**
  Medicine, energy, photocatalysis
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**2. Reading List**

**2.1 Compulsory Readings**

N/A

**2.2 Additional Readings**

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|---|---|
| 1. | "Understanding Solids: The Science of Materials", Richard Tilley, Wiley 2004 (ISBN: 0-470-85275-5) |
| 2. | "Nanostructures & Nanomaterials: Synthesis, Properties and Applications", Guozhong Cao, Imperial College Press 2004 (ISBN: 1-86094-480-9) |
| 3. | "Nanochemistry: A Chemical Approach to Nanomaterials", Geoffrey Ozin & Andre Arsenault, RSC Publishing 2005 (ISBN: 0-85404-664-X) |