City University of Hong Kong
Course Syllabus

offered by Department of Chemistry
with effect from Semester A 2022/23

Part I Course Overview

Course Title:	Nanochemistry and Nanobiotechnology
Course Code:	CHEM8014
Course Duration:	1 semester
Credit Units:	3 credits
Level:	R8
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)*	BCH8014 Nanochemistry and Nanobiotechnology
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course enables postgraduate students to have a general knowledge of nanoscience from nanohistory, nanofabrication, characterization and corresponding applications. Special focus will be on bottom-up wet chemistry preparation and post treatments (e.g. phase transfer/surface modification) of nanoparticles ranging from metal, metal oxide to quantum dot and their property-directed applications. Most importantly, students will be able to explain some phenomena observed in nanoscience by what they have learned in inorganic chemistry (e.g. ligand-chelating, HOMO-LUMO tuning…) and physical chemistry (e.g. colloidal and surface chemistry, flocculation state, thermodynamic/kinetic control, quantum confinement…). In addition, nanobiotechnology has become an emerging interdisciplinary area in this field for researching and solving biological phenomena and problems using nanochemistry and nanomaterials. For example, nanomaterials can serve as signalling nanoprobes, nanotools that manipulate mechanical forces, and vehicles that deliver drugs or biomolecules. A brief and intuitive introduction of nanomaterials and the characteristics and applications of nanobiotechnology will be presented at a level accessible to graduate students interested in nanomedicine, materials science, nanochemistry, and 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.	Review the development of nanofabrication and characterization tool and critically evaluate their advantages, limitations and challenges for research and application in nanoscience.	25%	✓	✓	
2.	Identify the role and function of nanocomponent in current artificial products and objects from the nature world and rationalize phenomena observed in nanoscience by what they have learned from chemistry textbook.	25%	✓	✓	✓
3.	Critically evaluate the principles and strategies for nanomaterials used in the literature especially in field of biotechnology and effectively communicate this knowledge within their peers.	25%	✓	✓	✓
4.	Design experiments to explore the principles in nanobiotechnology and evaluate current literature on novel approaches in corresponding applications.	25%		✓	✓
		100%			

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	
Lectures	Introduce the general background of nanoscience including preparation, characterization, applications of a wide range of nanoparticles and explain key phenomena observed in nanoscience from chemistry point of view. Special focus of applications will be put on nanobiotechnology.	✓	✓	✓		3 hrs/wk for 8 weeks
Literature review	Students will independently review current research articles in nanobiotechnology and related areas. Teaching and learning will entail extensive teacher-student interaction and supervised in-depths discussion among the students based on recent primary research articles, in order to foster independent and critical thinking of the students.	✓	✓	✓		3 hrs/wk for 1 week
Group activities (Presentations and assignments)	Students will work in small groups to create the ideas and present the selected topics. Assignment will be given for students to demonstrate the ability of literature search and create an idea with peers. Team work is emphasized in the form of group presentation and assignment of selected projects.			✓	✓	3 hrs/wk for 2 weeks
Lab demonstration	Prepare various nanoparticles and conduct post-surface modification by a wide range of wet chemistry methods for the targeted applications.	✓	✓	✓	✓	3 hrs/wk for 2 weeks

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.					Weighting*	Remarks
	1	2	3	4	5		
Continuous Assessment: 100%							
Individual Presentation	✓	✓	✓			20	
Individual Assignment	✓	✓	✓			20	
Class Discussion	✓	✓	✓	✓	✓	10	
Group Presentation and Assignment			✓	✓	✓	50	
Examination: 0% (duration: hours)							
						100%	

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for courses offered by CHEM:

"A minimum of 40% in both coursework and examination components."

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1.Individual presentation	Ability to analyse, discuss, organize and defend their own investigation relevant to nanobiotechnology.	High	Significant	Basic	Not even reaching marginal levels
2.Individual assignment	Ability to analyse and discuss problems to understand the topics of nanobiotechnology.	High	Significant	Basic	Not even reaching marginal levels
3.Class Discussion	Ability to participate in discussion.	High	Significant	Basic	Not even reaching marginal levels
4.Group presentation and assignment	1. Ability to communicate and create the ideas with colleagues. 2. Ability to analyse and evaluate and scientific problem/issues. 3. Ability to integrate the knowledge in this lecture to their interesting research.	High	Significant	Basic	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1.Individual presentation	Ability to analyse, discuss, organize and defend their own investigation relevant to nanobiotechnology.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2.Individual assignment	Ability to analyse and discuss problems to understand the topics of nanobiotechnology.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3.Class Discussion	Ability to participate in discussion.	High	Significant	Moderate	Basic	Not even reaching marginal levels
4.Group presentation and assignment	1. Ability to communicate and create the ideas with colleagues. 2. Ability to analyse and evaluate and scientific problem/issues. 3. Ability to integrate the knowledge in this lecture to their interesting research.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information

1. Keyword Syllabus

Definition of nanomaterial/nanotechnology and their general properties, Nanohistory, Cluster, Nanocomponent in artificial products/nature objects, Nanofabrication, Characterization, Wet chemistry preparation and post treatments, Colloidal chemistry, Surface chemistry, Aggregation and flocculation states, Thermodynamic/kinetic controlled particle growth and stability, Superparamagnetic/Plasmonic/Quantum confinement properties, Emerging fields of Nanobiotechnology, Nanobiosensor, Nanobioimaging, Drug delivery, Therapy, Nanodevice

2. Reading List

2.1 Compulsory Readings

1.	K. S. Birdi, Handbook of Surface and Colloid Chemistry (4th ed), CRC Press, 2015.
2.	J.-C. Joud and M.-G. Barthés-Labrousse, Physical Chemistry and Acid-base Properties of Surfaces, Wiley, 2015.
3.	G. E. J. Poinern, A Laboratory Course in Nanoscience and Nanotechnology, CRC Press, 2015.
4.	Appropriate selected research papers. To be provided, as required.

2.2 Additional Readings

1.	
2.	
3.	
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