City University of Hong Kong
Course Syllabus

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

Part I Course Overview

Course Title:	**Topics in Polymer Science**
Course Code:	**AP6174**
Course Duration:	**One semester**
Credit Units:	**3**
Level:	**P6**
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)*	**AP8174 Topics in Polymer Science**

Part II Course Details

1. Abstract

This course aims to develop basic research skills and introduce recent research developments in polymer science and engineering.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Describe the molecular nature in polymers.		✓		
2.	Discover the characteristics of polymers by applying experimental techniques.			✓	
3.	Create innovative design of polymer matrix composites using micromechanic theories.				✓
4.	Recognize the environmental issues related to polymers.			✓	
		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)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
1.	Lecture	√	√	√	√			26
2.	Laboratory		√	√				12
3.	Group project and presentation	√	√	√	√			14

*** The "Total no of hours" includes only the scheduled studying time. Students should spend additional hours in self-study in order to achieve the CILOs.**

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4				
Continuous Assessment: 50%								
Lab Report		√	√				10%	
Group-project report	√	√	√	√			40%	The Group-project report mark will be based on a group presentation as well as individual report.
Examination: 50% (duration: 2 hrs)								
							100%	

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Lab Report	ABILITY to EXPLAIN in DETAIL and with ACCURACY on experimental aspects of polymer science	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Group-project report	CAPACITY for SELF-DIRECTED LEARNING to aspects of polymer science	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	ABILITY to EXPLAIN the technical details of polymer science	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

(An indication of the key topics of the course.)

- Overview of different classes of materials and crystalline phases (6 hours)
  Metals, ceramics, polymers, and construction materials. Structure, size effect (micro to nano), dislocation, grain/interphase boundary.
- Thermodynamics & kinetics (5 hours)
  Phase diagram, amorphous state, diffusion, crystallization from amorphous solids
- Mechanical behaviour (12 hours)
  The elastic moduli: bonding between atoms, physical basis of modulus, case studies of modulus-limited design. The yield strength and tensile strength: Micro- and nanohardness, ductility, dislocations and yielding in crystals, strengthening method, plasticity of polycrystals, (negative) Hall-Petch relation, continuum aspects of plastic flow. Fracture and toughness: micro-mechanism of fast fracture, fatigue failure. Creep and creep fracture: kinetic theory of diffusion, mechanism of creep, creep resistant materials.
- Introduction to corrosion (3 hours)
  Basic electrochemistry, mechanism of various forms of corrosion, anodic and cathodic protection, corrosion inhibitors, surface modification methods for improving wear and corrosive resistance.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

Nil

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	Michael F. Ashby and David R.H. Jones, "Engineering materials 1 : an introduction to properties, applications and design", 4th Ed, Amsterdam ; Boston : Elsevier Butterworth-Heinemann, 2012.
2.	Michael F. Ashby and David R.H. Jones, "Engineering materials 2 : an introduction to microstructures, processing and design", 3rd Ed, Oxford ; Burlington, MA : Elsevier/Butterworth-Heinemann, 2006.
3.	R A Flinn and P K Trojan, "Engineering Materials and Their Applications", 4th Ed, John Wiley & Sons, New York, 1990.
4.	William D Callister, Jr, and David G. Rethwisch, "Materials Science and Engineering, An Introduction", 8th Ed, Wiley, New York, 2010.