[CENG1500] A First Course on Materials Science and Applications Course Syllabus

No. of Credits: 3

Pre-/co-requisites: None

Course Instructor: Prof. Cindy Tang
Email: cindytang@ust.hk
Office hour: Monday 15:00-16:00 (Rm 4587)

	Lectures (Instructor: Prof. Cindy Tang)	**Tutorials** (Instructor: Teaching assistants)
Date & Time	Monday 13:30 – 14:50 Friday 09:00 – 10:20	Monday 12:00 – 12:50
Location	Rm 1527	Rm 4504

Course Description

This is an introductory course for Chemical and Biological Engineering (CBE) students to provide foundational knowledge on the science and engineering of materials. The course will apply the basics of physics and chemistry to the properties of materials. Students will learn how atomic and microscopic properties affect the macroscopic levels, how materials' structures can be engineered to achieve desired properties, and what unique tools are used to study materials properties.

Intended Learning Outcomes (ILO)

By the end of this course, students should be able to:

ILO1: Understand the basic building blocks, structural components and classification of materials
ILO2: Correlate structure (crystalline and noncrystalline), bonding of atoms, defects, etc to material properties
ILO3: Analyze and use phase diagrams to understand and predict microstructures and properties of materials.
ILO4: Describe the properties of materials (e.g. physical, electrical, thermal, chemical, optical)
ILO5: Common characterization techniques for materials
ILO6: Evaluate materials for practical engineering applications in modern technologies

Textbooks (optional)

William D. Callister Jr., David G. Rethwisch. Callister's Materials Science and Engineering, Global Edition, 10th Ed.

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessment Task	Contribution to Overall Course Grade (%)	Due date
In-class tutorial activities	6*2.5% = 15%	Week 3 to 14
Quizzes	2*12.5% = 25%	Oct 2, Nov 20
Mid-Term Exam	25%	Oct 23
Final Exam	35%	Dec 7 to 19

Mapping of Course ILOs to Assessment Tasks

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessed Task	Mapped ILOs	Explanation
In-class tutorial activities	ILO 1-5	This task assess students' ability to catch up with the lecture materials and implement the theoretical knowledge discussed in the lectures.
Quizzes	ILO 1-5	These small stakes quizzes will measure individual learning outcomes on key concepts and theories in the course and provide feedback to students.
Mid-Term Exam	ILO 1-2, 4	Exams are designed to assess students' foundational understanding of the concepts, aligning with the lower-order thinking skills of remembering and Understanding.
Final Exam	ILO 1-6	

In-class tutorial activities

Students are required to attend all tutorials (attendance will be taken). In-class activities are to be submitted by end of each tutorial class.

Quiz

Quizzes will be held in-person as per Schedule below.

Mid-Term Exam

Mid-term exam will be held in-person as per Schedule below.

Final Exam

Final exam will be a comprehensive exam covering all the contents taught in the course. Exam schedule will be separately released by HKUST. Please refer to Examination Timetable and Venues | HKUST – Academic Registry for latest timetable.

Report on Illness or Other Circumstances Affecting Assessment

If you have a valid medical reason for missing the tutorial, quiz, mid-term or final exam, you'll need to email Prof. Cindy Tang (cindytang@ust.hk) *at least 1 hour before* the tutorial/quiz/exam with:

(i) A medical certificate issued by a registered medical practitioner,
(ii) Filled form "[Form EX-16] Report on Extenuating Circumstances Affecting Assessment" as per HKUST's policy – refer to Application Forms for Current Students | HKUST – Academic Registry, and
(iii) Submit the completed form (after approval by Prof. Cindy Tang) to Academic Registry.

Requests after the exam date will not be accommodated. Prof. Cindy Tang will consider each case individually and determine an action that is deemed appropriate. Examples of the action may include but not limited to:

- Reject the request if the case does not warrant any special arrangement
- Require students to write a make-up examination with or without marks deduction
- Require students to re-take a course assessment with or without marks deduction
- Adjust weighting of the grade for the involved assessment that make up the final grade

Communication and Feedback

• Gradings for each assessment will be within two weeks of submission.

• Students seeking clarification or further feedback, including grades, should consult the instructor/ teaching team within one week of receiving the feedback or grades.

• Students who require additional help may book an appointment on Canvas for the abovementioned office hour.

Course AI Policy

The use of AI for completion of in-class tutorial activities are strictly NOT permitted. The assessments are designed to measure your understanding of the class content and problem-solving ability, so you must still invest the time to think critically. Students may consult lecture notes, own notes, textbooks or other reference material in printed or electronic form, and may bring an iPad, laptop or other personal device for this purpose. Peer discussions are allowed and highly encouraged. A zero grade for the in-class tutorial activities will be given to students caught using AI.

Students have the freedom to use AI (outside of class/tutorial hours) for conceptual help. However, this technology is intended only to aid learning; it should never circumvent the mental work required.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

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Grading Rubrics

Homework Rubrics

Criteria	Excellent (90% – 100%)	Good (75% – 89%)	Satisfactory (60% – 74%)	Marginal (50% – 59%)	Fail (<50%)
Calculation Accuracy	All calculations are entirely correct, with appropriate units, reasonable significant figures, and no arithmetic errors.	Calculations are largely correct, with only minor arithmetic or unit errors that do not significantly affect the final result.	Calculations are mostly correct but contain several errors in arithmetic, units, or significant figures that lead to a somewhat inaccurate final answer.	Calculations contain significant errors that undermine the validity of the final result, though the general approach is somewhat recognizable.	Calculations are largely or entirely incorrect, with no coherent application of formulas or use of units.
Grasping Concepts	Demonstrates deep understanding of underlying principles, correctly identifies key variables, and can apply the concepts to the specific problem with insight.	Demonstrates a solid understanding of the main principles, correctly identifies most key variables, and applies the concepts appropriately to the problem.	Demonstrates a general understanding of the core concepts but may misidentify some variables or show a superficial grasp of the principles involved.	Shows a weak understanding of the fundamental concepts, often misapplying them or confusing them with unrelated ideas.	Fails to demonstrate any meaningful understanding of the required principles or concepts.
Clarity of Explanation	Explanations are exceptionally clear, concise, and well-organized. The solution logic and workflow are easy to follow from start to finish.	Explanations are clear and organized, with a logical flow that is easy to follow, though perhaps slightly verbose or missing a minor detail.	Explanations are generally understandable but may be disorganized, verbose, or missing some steps in the logical flow.	Explanations are confusing, poorly organized, or contain significant gaps in logic, making the solution difficult to follow.	Explanations are absent, incoherent, or fail to describe the solution process in any meaningful way.

Final Grade Descriptors

Grade	Short Description	Elaboration on subject grading description
A	Excellent Performance	Students with excellent performance in the course demonstrate a strong grasp of lecture materials, competent completion of all in-class tutorial activities, and exceling in quizzes and exams. They exhibit effective utilization of knowledge and concepts discussed in class.
B	Good Performance	Students with good performance in the course demonstrate a solid understanding of lecture materials, competent completion of in-class tutorial activities, and achieving good performance in quizzes and exams. They showcase commendable utilization of knowledge and concepts discussed in class.
C	Satisfactory Performance	Students with satisfactory performance in the course demonstrate an adequate understanding of lecture materials, partial completion of in-class tutorial activities, and achieving acceptable performance in quizzes and exams. They showcase satisfactory utilization of knowledge and concepts discussed in class.
D	Marginal Pass	Students with marginal pass in the course show limited understanding of lecture materials, inconsistent completion of in-class tutorial activities, and marginal performance in quizzes and exams. They exhibit limited utilization of knowledge and concepts discussed in class.
F	Fail	Students who fail the course display a lack of understanding of lecture materials, inadequate completion of in-class tutorial activities, and poor performance in quizzes and exams. They exhibit little utilization of knowledge and concepts discussed in class.

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Schedule

There will be no classes on public holidays (19 Oct). Schedule and content may subject to changes upon course instructor's discretion.

Week	Date	Topics	Assessment
1 -2	4 Sep 7 Sep 11 Sep	Course administration; Lecture: Atomic Structure and Interatomic Bonds **No tutorial on 7 Sep**	-
3	14 Sep 18 Sep	Tutorial: In-class activity Lecture: Crystal structures	2.5%
4	21 Sep 25 Sep	Tutorial: In-class activity Lecture: Crystal Structures, Material Characterization	2.5%
5	28 Sep 2 Oct	Tutorial: Quiz 1 Lecture: Material Characterization, Diffusion	12.5%
6	5 Oct 9 Oct	Tutorial: Quiz 1 solution Lecture: Mechanical Properties	-
7	12 Oct 16 Oct	Tutorial: In-class activity Lecture: Failure of Materials, Phase diagrams	2.5%
8	23 Oct	Lecture: Mid-Term Exam	25%
9	26 Oct 30 Oct	Tutorial: Mid-Term Exam solution Lecture: Phase diagrams, Chemical Properties	-
10	2 Nov 6 Nov	Tutorial: In-class activity Lecture: Polymers	2.5%
11	9 Nov 13 Nov	Tutorial: In-class activity Lecture: Electronic Materials	2.5%
12	16 Nov 20 Nov	Tutorial: In-class activity Lecture: Optical Properties	2.5%
13	23 Nov 27 Nov	Tutorial: Quiz 2 Lecture: Optical Properties, Materials in Engineering Design	12.5%
14	30 Nov	Tutorial: Quiz 2 solution Lecture: Revision	-