The Hong Kong University of Science and Technology (Guangzhou)

UG Course UCUG 1702 Syllabus

Introduction to Materials Science and Applications

UCUG 1702

3 Credits

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Office Hours: To be determined based on request

Course Description

This course is to introduce the field of materials science and engineering and to survey the role that materials have played in shaping our society. This course will introduce different categories of materials and elucidate their applications. Concepts of different kinds of materials and the basic structures at different scales will be studied. Relevant design and principles will be explored to understand the structure property relationship, with the purpose of providing a foundation for students to understand the common properties of materials and to evaluate the social, economic, and environmental impact of materials.

Intended Learning Outcomes (ILOs)

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

1. Explain the basic structures and properties of materials used in our daily life, and discuss the novel applications of selected advanced materials

2. Explain basic techniques for measuring the common properties of materials, and for fabricating and processing of novel materials

3. Evaluate the social, economic, and environmental impact of materials

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.

Assessments:

In-class test: The test will be constructed to solve paper-based questions twice a semester, primarily 3-5 short questions to help students assess their progress in learning about the course materials.

Mid-term test: The test will be constructed to solve paper-based questions, primarily 3-5 short questions to help students evaluate their understanding of course materials during the semester.

Final exam: The exam will be constructed to solve paper-based questions, covering short and long questions.

Written assignment: Students will be asked to solve some paper-based questions based on weekly learning.

Project report: Students will be asked to submit a report to describe a topic of interest based on course materials.

Assessment Task	Contribution to Overall Course grade (%)	Due date
In-class quiz	10%	dd/mm/yyyy *
Mid-term test	20%	dd/mm/yyyy *
Written assignment	10%	dd/mm/yyyy *
Project report	30%	dd/mm/yyyy *
Final examination	30%	dd/mm/yyyy

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
In-class test	ILO1, ILO2	Questions will prompt them to think about concept and their own development in the future
Mid-term test	ILO1, ILO2	Questions will prompt them to think about concept and their own development in the future
Final exam	ILO1, ILO2	Questions will prompt them to think about concept and their own development in the future
Written assignment	ILO1, ILO2	Questions will be at an easy-to-solve level, to help students pick up or refresh knowledge through books or lectures. 20% is about right
Project report	ILO1, ILO2, ILO3	The group /team will need to provide a team project report
Group project and presentation	ILO1, ILO2, ILO3	The group project and presentation will be assessed through completion of project and peer + instructors' review

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive understanding of materials science, their societal and economic impact, and its relationship with technology. Exhibits exceptional expertise in problem-solving, and significant creativity in thinking. Exhibits a high capacity for scholarship and collaboration, going beyond core requirements to achieve learning goals]
B	Good Performance	Shows good knowledge and understanding of the materials science, their societal and economic impact, and its relationship with technology. Demonstrate strong competence in problem-solving, and the ability to analyze and evaluate issues. Displays high motivation to learn and the ability to work effectively with others.
C	Satisfactory Performance	Possesses adequate knowledge of materials science, the relationship between materials and surrounding environment. Exhibits reasonable competence in dealing with familiar problems, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals.
D	Marginal Pass	Has threshold knowledge of materials science, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline.
F	Fail	Demonstrates insufficient understanding of the materials science, and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.

Course AI Policy

The course allows the use of the use of generative artificial intelligence tools to complete written assignment, in-class tests and project report. Other assessment tasks such as mid-term test and final exam are prohibited from the use of generative artificial intelligence tools unless specified in exam questions otherwise.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include [specific details, e.g., strengths, areas for improvement]. Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

Required Texts and Materials

Materials Science and Engineering: An Introduction 10th edition, William D. Callister and David G. Rethwisch, Wiley, 2018

Academic Integrity

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

Weekly Schedule

Week	Topics	Description	CILO	Instructors
1	Introduction	A general view of materials role in society	CILO-1, CILO-2, CILO-3	Dr. Chee Keong TAN
2	Atomic structure and bonding	Fundamental concept forming materials	CILO-1, CILO-2	Dr. Chee Keong TAN
3	Crystal structure	How crystals are formed and the role of structures	CILO-1, CILO-2	Dr. Chee Keong TAN
4	Lattice position and plane	Concept in describing structures	CILO-1, CILO-2	Dr. Chee Keong TAN
5	X-ray diffraction	Techniques and principles used to probe crystal structure	CILO-1, CILO-2	Dr. Chee Keong TAN
6	Crystal defects	Introduction of how defects form in crystal	CILO-1, CILO-2	Dr. Chee Keong TAN
7	Diffusion	Concepts on how atoms move in crystal	CILO-1, CILO-2	Dr. Chee Keong TAN
8	Mechanical properties	Fundamental properties in materials related to elasticity	CILO-1, CILO-2	Dr. Chee Keong TAN
9	Thermal behaviour	Fundamental properties in materials related to heat energy	CILO-1, CILO-2	Dr. Chee Keong TAN
10	Phase diagram	Principles to understand equilibrium and nonequilibrium states in materials	CILO-1, CILO-2	Dr. Chee Keong TAN
11	Structure materials	Technologies and applications related to metals, ceramics and polymers	CILO-1, CILO-2, CILO-3	Dr. Chee Keong TAN
12	Electronic and magnetic materials, optical and bio-related materials	Technologies and applications related to semiconductor and superconductor, biomaterials and interaction between optics and materials	CILO-1, CILO-2, CILO-3	Dr. Chee Keong TAN
13	Group presentation	Introduction of materials	CILO-1, CILO-2, CILO-3	Dr. Chee Keong TAN