The Hong Kong University of Science and Technology

UG Course Syllabus

Engineering Materials II

MECH 3420

3 Credits

Pre-Requisites: MECH 2410

Name: Hong Tao

Email: maehongtao@ust.hk

Office Hours: By appointment

Course Description

This course provides a comprehensive overview of advanced engineering materials, focusing on: (1) foundational engineering material properties (i.e. electrical, thermal, magnetic, and optical); (2) green and smart building materials (i.e. ceramics, polymers, and smart insulation materials); and (3) aerospace engineering materials (i.e. Aluminum, Magnesium, Titanium, and Super alloys) as well as materials degradation. Students will apply theoretical concepts to real-world scenarios through case studies, product design analysis, and interdisciplinary problem-solving.

Intended Learning Outcomes (ILOs)

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

1. Acquire a complete knowledge set through calculation and analysis of the electrical, thermal, magnetic, optical properties of engineering materials;
2. Develop rigorous problem-solving skills in structure – properties relationship in ceramics and polymers;
3. Perform analysis of advanced metal alloys applications in aerospace structures and engines.
4. Enhance their employability and career readiness in engineering materials-related industries and gain a competitive edge for both job hunting and further academic study arrangements.

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:

[List specific assessed tasks, exams, quizzes, their weightage, and due dates; perhaps, add a summary table as below, to precede the details for each assessment.]

Assessment Task	Contribution to Overall Course grade (%)	Due date

In-Class Activities	20%	On 9 selected dates
Assignments	30%	04/10/2026; 01/11/2026; 30/11/2026;
Final Exam	50%	Final Examination Period

Mapping of Course ILOs to Assessment Tasks

Assessed Task	**Mapped ILOs**	**Explanation**
In-Class Activities	ILO1, ILO2, ILO3	Assesses students' foundational understanding of material properties (ILO1) and problem-solving (ILO2, ILO3) through active participation in case studies.
Assignment	ILO1	Evaluates students' grasp of core concepts in materials electrical, thermal, magnetic, and optical properties and their applications (ILO1).
Final Exam	ILO1, ILO2, ILO3	Comprehensively evaluates the total knowledge set acquired across all modules and critical problem-solving capabilities.

Grading Rubrics

The following rubric guides the evaluation of in – class activities, assignments, and the final exam:

Performance	Marks	Description
Excellent	≥ 80	Demonstrates complete mastery of core principles, executes calculations accurately, and provides profound understanding of the theories applied in real-world applications
Good	70 – 79	Exhibits strong comprehension of theoretical concepts and generally accurate calculations and analysis in problem-solving.
Satisfactory	60 – 69	Shows basic understanding of the three modules, but minor errors in calculations and analysis and with noticeable gaps in methodology or application.
Marginal	50 – 59	Displays limited understanding of fundamental concepts, struggles with analytical thinking, and requires significant guidance.
Fail	< 50	Fails to demonstrate basic competency in mechanical and aerospace engineering principles.

Final Grade Descriptors:

Grades	**Short Description**	**Elaboration on subject grading description**
A	Excellent Performance	Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking. Engages with constant effort in all class activities and collaborations, going beyond core requirements to achieve learning goals.
B	Good Performance	Shows good knowledge and understanding of the main subject matter, 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 core subject matter, 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 core subject matter, 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	Lacks of engagement in class activities and collaborative work. 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

This course allows students to use generative AI tools to assist understanding of technical concepts, to review course contents, and to summarize literature sources for projects.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments includes which answers are wrong and what are the correct ones. Feedback on final project includes the strengths and the areas for further 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; 9th Edition, William D. Callister, Jr.

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.

[Optional] Additional Resources

Smart buildings : advanced materials and nanotechnology to improve energy-efficiency and environmental performance, Marco Casini

Introduction to aerospace materials, Adrian P. Mouritz