

The Hong Kong University of Science and Technology

UG Course Syllabus

[Construction Materials Technology]

[CIVL 4810]

[3 credits]

[No pre-/co-requisites] CIVL 2810

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Course Description

This course introduces the fundamental principles, engineering behavior, processing, performance, and applications of major construction materials. The course begins with the scientific foundations required to understand material behavior, including atomic bonding, material structure, mechanical properties, fracture, rheology, surface phenomena, and thermal and electrical properties. These principles are then applied to major classes of construction materials: metals and alloys, concrete and cementitious materials, polymers, fiber composites, and glass.

Particular emphasis is placed on establishing relationships among material composition and structure, processing, properties, performance, and durability. Topics include strengthening and corrosion of metals; cement hydration and concrete technology; fresh and hardened concrete behavior; mix design and durability; polymer structure and time-dependent behavior; fiber–matrix interactions and composite mechanics; and the manufacture, strengthening, performance, and structural use of glass.

The course is delivered through lectures, examples, engineering case studies, problem-solving exercises, and a group project. Students are expected to apply fundamental materials science concepts to explain and evaluate the behavior of construction materials in engineering applications.

Intended Learning Outcomes (ILOs)

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

1. Explain and apply fundamental materials science principles related to atomic bonding, material structure, mechanical behavior, fracture, rheology, surfaces and interfaces, and thermal behavior.
2. Analyze the behavior of metals and alloys by relating microstructure, deformation, strengthening mechanisms, processing, and corrosion to their engineering properties and structural applications.
3. Evaluate cementitious materials and concrete in terms of constituent materials, cement hydration, fresh and early-age behavior, deformation, strength, mix design, durability, testing, and long-term performance.
4. Explain the structure, processing, properties, and construction applications of polymers and fiber composites, including the roles of fiber architecture, matrices, interfaces, bonding, and durability.

5. Evaluate the manufacture, strengthening, mechanical behavior, durability, and engineering applications of glass as a construction material.
6. Integrate material structure, processing, properties, durability, and engineering requirements to compare construction materials, diagnose material-performance problems, and communicate technically supported engineering conclusions.

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
Homework	20%	Throughout the semester*
Mid-Term	20%	14/10/2026*
Group Project and Presentation	10%	25/11/2026*
Final examination	50%	University examination period*

* 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
Homework	ILO 1, ILO 2, ILO 3, ILO 4, ILO 5	Homework assesses students' ability to understand and apply fundamental material concepts, perform engineering calculations, analyze material behavior, and compare different construction materials.
Mid-Term Examination	ILO 1, ILO 2, ILO 3	The mid-term assesses fundamental understanding of materials science principles and the ability to apply these principles to the analysis of construction-material behavior.
Group Project and Presentation	ILO 1, ILO 2, ILO 3, ILO 3, ILO 4, ILO 5, ILO 6	The project assesses students' ability to integrate material structure, processing, properties, durability, and engineering application and to communicate a technically supported analysis.
Final Examination	ILO 1, ILO 2, ILO 3, ILO 3, ILO 4, ILO 5, ILO 6	The final examination provides comprehensive assessment of conceptual understanding, quantitative problem solving, material-performance analysis,

		material comparison, and integrated engineering judgment.
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Grading Rubrics

Homework

Excellent

Solutions are technically accurate and complete. Relevant concepts are correctly selected and applied, calculations are clearly presented, and results are interpreted in appropriate physical and engineering terms.

Good

Solutions demonstrate good understanding and are mostly correct, with minor errors that do not substantially affect the overall reasoning or conclusions.

Satisfactory

Solutions demonstrate adequate understanding of the principal concepts but contain some conceptual, computational, or interpretative weaknesses.

Marginal

Solutions demonstrate only basic understanding and show significant difficulties in selecting or applying appropriate principles.

Unsatisfactory

Solutions demonstrate insufficient understanding of fundamental concepts and contain major errors in methodology or interpretation.

Group Project and Presentation

An excellent project demonstrates a strong understanding of the selected material system, establishes clear relationships between material structure, processing, properties, and engineering performance, critically evaluates relevant issues, and communicates the results clearly and professionally. Lower levels of performance will reflect progressively weaker technical understanding, limited analysis, insufficient integration of material concepts, or ineffective communication.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates comprehensive understanding of construction-material principles and excellent ability to apply them to both familiar and unfamiliar engineering problems. Effectively connects material structure and processing with properties, durability, and engineering performance.
B	Good Performance	Demonstrates good knowledge and understanding of the main subject matter and can apply relevant principles effectively to most engineering problems. Shows sound analytical and problem-solving ability.
C	Satisfactory Performance	Demonstrates adequate understanding of core concepts and can solve familiar problems using appropriate methods. Shows some ability to analyze material behavior and engineering performance.

D	Marginal Pass	Demonstrates threshold understanding of the subject and can address basic problems but has difficulty applying or integrating concepts in more demanding situations.
F	Fail	Demonstrates insufficient understanding of the subject matter and lacks the necessary analytical and problem-solving skills to meet the intended learning outcomes.

Course AI Policy

Generative artificial intelligence tools may be used as supplementary learning tools for activities such as exploring course concepts, generating practice questions, brainstorming project ideas, and improving language clarity.

For homework assignments, students may use generative AI to assist with learning and clarification, but all submitted calculations, reasoning, interpretations, and answers must represent the student's own understanding. Students remain fully responsible for the correctness of submitted work.

For the Group Project and Presentation, generative AI may be used for brainstorming, language editing, and presentation preparation. Any substantive use of generative AI should be disclosed.

Students should independently verify AI-generated technical claims, numerical results, equations, and references.

Generative AI tools are not permitted during the Mid-Term Examination or Final Examination unless explicitly authorized by the instructor.

Communication and Feedback

Course announcements, lecture notes, homework assignments, assessment information, and grades will be communicated through Canvas.

Feedback may include comments on conceptual understanding, problem-solving approach, accuracy of calculations and technical communication. Students who have questions regarding feedback or marks should consult the instructor within five working days after the feedback is released.

Resubmission Policy

Resubmission of assessed homework or project work is normally not permitted after the submission deadline.

Where exceptional circumstances are formally recognized by the University, alternative arrangements may be made in accordance with university regulations.

Late submissions without approved justification may be subject to penalties specified in the corresponding assessment instructions.

Required Texts and Materials

Soutsos, M. and Domone, P. (eds.), *Construction Materials: Their Nature and Behaviour*, 5th Edition, CRC Press / Taylor & Francis.

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.