

The Hong Kong University of Science and Technology

UG Course Syllabus Template

[Course Title] Advanced Construction with AI and Robotics [Course Code] CIVL4210

[No. of Credits] 3

[Prerequisite] CIVL 1121 OR COMP 1021 OR COMP 1022P (prior to 2025-26) OR COMP 1023

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Course Description

This multi-faceted course encompasses advanced technologies in infrastructure and building construction, maintenance and operations. The course provides deep learning methods in computer vision and robot sensing with hands-on coding training on solving construction management problems with these methods. Combined with tools from AI and robotics, the course equips students with leading-edge knowledge and practices to bring about successful construction reform in the context of the smart city.

The course is a mixture of lectures, tutorials, and student projects. The concept, theory and applications of AI and robotics in construction are delivered through lectures. The tutorials provide hands-on exercises on AI and robotics software development toolkits to learn how to apply these tools with given data. Through mini-projects, students explore the use of the toolkits for practical problem-solving in construction.

Intended Learning Outcomes (ILOs)

Upon completion of the subject, students will be able to:

1. Apply AI tools to building and construction data.
2. Evaluate the appropriateness of AI and robotics in building and infrastructure construction, maintenance, and operations.
3. Incorporate AI and robotics for practical construction engineering and management issues.

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:

Assessments include assignments, quizzes, and a mini project, as summarized below.

Assessment Task	Contribution to Overall Course grade (%)	Due date
Assignment	40%	Every one or two weeks *
Quiz	20%	Tentatively in week 3 and week 5 *
Mini project	40%	Tentatively in week 7 and week 13 *

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

Mapping of Course ILOs to Assessment Tasks

[add to/delete table as appropriate]

Assessed Task	Mapped ILOs	Explanation
Assignment	ILO1, ILO2, ILO3	This task assesses students' ability to understand and apply AI concepts and tools (ILO 1), evaluate their implications (ILO 2), and critically analyze their role in the industry (ILO 3).
Quiz	ILO1, ILO2	Quizzes are designed to assess students' foundational understanding of AI concepts (ILO 1) and their ability to differentiate AI from construction management (ILO 2), aligning with the lower order thinking skills of remembering and understanding.
Mini project	ILO1, ILO2, ILO3	This task assesses students' ability to understand and apply AI concepts and tools (ILO 1), evaluate their implications (ILO 2), and critically analyze their role in the industry (ILO 3).

Grading Rubrics

Detailed grading rubrics are provided for assignments, quizzes, and the mini project. These rubrics outline the criteria used for evaluation and help students understand how their work will be assessed.

Final Grade Descriptors:

Final grades are assigned according to students' demonstrated understanding, application, problem-solving ability, analytical thinking, engagement, and achievement of the course ILOs.

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive understanding of AI and robotics concepts and their application in construction. Excels in problem-solving, innovation, and creativity, with outstanding ability to design and implement solutions for complex construction

		challenges. Participates actively and shows exceptional capacity for collaboration and leadership.
B	Good Performance	Shows strong knowledge of AI and robotics concepts and their application in construction. Demonstrates competence in problem-solving and analysis, with the ability to evaluate and apply tools and algorithms effectively. Displays high motivation and a proactive approach in learning and group work.
C	Satisfactory Performance	Possesses adequate understanding of AI and robotics in construction, with the ability to solve familiar problems and analyze issues at a basic level. Shows persistence and effort to achieve learning objectives but lacks depth or creativity in applying concepts to new challenges.
D	Marginal Pass	Displays threshold knowledge of AI and robotics in construction, with minimal ability to apply concepts effectively or solve problems. Shows limited analytical or critical thinking skills, but demonstrates potential to develop further with focused effort and guidance.
F	Fail	Demonstrates insufficient understanding of AI and robotics concepts, with inability to apply knowledge to construction problems. Lacks problem-solving, critical thinking, and engagement. Fails to meet the necessary requirements for progression or professional development.

Course AI Policy

The use of Generative AI in project is permitted with proper acknowledgement and will NOT be contributed to the students' work.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

Late submission Policy

To ensure fairness for students who submit assignments on time, late submissions will not be accepted, and a score of zero will be assigned.

Required Texts and Materials

Rafael Sacks, Chuck Eastman, Ghang Lee, Paul Teicholz (2018) BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, 3rd Edition. Wiley.

Zacharias Voulgaris and Yunus Emrah Bulut (2018) AI for Data Science: Artificial Intelligence Frameworks and Functionality for Deep Learning, Optimization, and Beyond First Edition, Technics Publications.

Bock, T., & Linner, T. (2016). Construction Robots Elementary Technologies and Single-Task Construction Robots. In Construction Robots: Elementary Technologies and Single-Task Construction Robots (p. I). Cambridge: Cambridge University Press.

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.