2023 Fall

1	Course Code:	CIVL4210
2	Course Title:	Advanced Construction with AI and Robotics
3	Course Credits:	3
4	Class Quota:	30
5	Duration / Offering Term:	One 3-hour lecture per week, 13 weeks/Fall 2023-24
46	Lecture/tutorial/lab hour per week	Lecture
7	Targeted Student Group:	Year 3 and 4 UG students
8	Prerequisite (if any):	COMP2011 OR COMP2012 OR COMP2012H
9	Exclusion (if any):	Nil
10	Corequisite (if any)	Nil
11	Instructor:	Yantao YU (ceyantao@ust.hk)
12	Enrolment requirement (e.g., Instructor's approval is required):	Instructor's approval is required.
13	Course Description: (within 150 words)	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.
14	Tentative course structure:	**Topics 1:** AI and sensing technology in construction - Introduction to machine learning - Introduction to deep learning - Smart construction empowered by AI - In-class activity: data visualization with python, construction equipment identification with deep learning, crack identification with deep learning **Topic 2:** Robotics in Construction - Introduction to robot components - Civil and infrastructure industrial robots - Engineering feasibility of construction robot applications **Topic 3:** Simulation techniques in Construction - BIM, CIM, and smart city - Digital Twin and Metaverse - Simulation methods for construction management

15	Intended learning outcomes (ILOs) of the course:	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
16	Rationale for introducing the course:	The proliferation of AI and robotics are opening up new opportunities for the construction industry. Blending construction domain knowledge with advanced digital technologies, this course investigates how AI and robotics benefit the construction, maintenance, and operation of buildings and infrastructures. Students learn about and use AI and robotics tools and technologies to solve the problems in construction practice.
17	Textbook / Reference books:	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.
18	Grading Scheme	In-class test (30%), Participation (10%), Project (60%)
19	Grading Type (PP/P/F/Letter)	Letter