

Course Syllabus

Course Code	TEMG4940D
Semester	Summer 2024 (Jun 17 – Aug 10)
Course Title:	T&M Prototyping and Research Project: Developing Smart Digital solutions for Net Zero Carbon Building with AECOM
Course Credit:	3
Pre-requisites	NIL
Max Class size:	20 students
Course enrollment:	All DDP students are welcome. i) Year 3 to 4 students preferred. Instructor consent is required. ii) Priority for students who have completed <u>any of the following</u> TEMG3950, LABU2040, ISDN/ENTR 3360, ISOM4000C, MGM4220
Class schedule	Saturday (1- 6pm) Lecture and Workshop on campus 1 visit to AECOM office on weeknight.
Classroom:	Rm 4582 type classroom
Instructor:	Dr. Daniel Chun Tel 3469-2950 Email djychun@ust.hk With industry sponsor (AECOM) and industry professionals

Course Description

The goal of TEMG4940 series of experiential-learning courses is for T&M-DDP students to gain deep insight into an industry domain by working with corporate-sponsor(s) to understand a new trend in the industry, appreciate the business challenges behind the problem, and develop a working prototype incorporating innovative business strategies and advanced software tools.

In the past, we have used this project-based learning format on following topics:

- Anonymous shareholder voting using BLOCKCHAIN
 - Real-time tracing of low-latency trade anomalies using SPLUNK
 - Resource allocation optimization of jobs in Azure Cloud using GREEDY algorithm
 - Ranking of investment opportunities in Crunchbase using MACHINE LEARNING algorithms
 - Prediction of credit rating migration for financial institutions using MACHINE LEARNING algorithms
- Course credits ranges from 3 to 5 credits, depending on the complexity of each case challenge.

Students may not repeat the project if case challenges are too similar. Instead, such students may be invited to participate as student-TA.

Reminder: 1 credit is approximately 13 hours of class-meeting and 26 hours of work. For a 4-week winter term, 3 credits should be 30-40 hours of prototyping, research or meeting per week.

Long course title

Developing Smart Digital Solutions for Achieving Net Zero Carbon Emissions in Building Construction and Management, in Collaboration with AECOM. This course, aimed at Dual Degree Program students, combines theoretical knowledge with practical application through direct industry engagement, focusing on innovative strategies and digital tools to address energy efficiency and sustainability in the lifecycle of buildings, from design through operation to decommissioning, with a special emphasis on air conditioning and lighting systems in Hong Kong's unique climate

This course explores with our collaboration partner AECOM in one of the following or similar problem statement and use case for achieving Net Zero Carbon Building

Buildings are responsible for most of Hong Kong's energy usage across their entire lifecycle of construction, operation (such as air conditioning and lighting), and end-of life. How can **digital solutions** be applied to reduce the energy load throughout their life cycle?

The following sub-problem statements are to be investigated.

- How might we reduce the energy consumed by air-conditioning in buildings in HK?
- How might we find the right balance for lighting up the city but at the same time use smart ideas for alternative lighting?
- How might we apply digital solutions to reduce the energy load of these and other building related end uses?
- How might we use the right building technologies for our climate which is both tropical and temperate due to the change in seasons?
- How might we envision buildings of the future constructed in new ways with modulated integrated construction?

A project proposal will necessitate the integration of digital tools and UX/UI prototyping, alongside appropriate business processes pertinent to the proposal

Project Sponsor

AECOM is a global engineering and construction company that provides a range of architecture, engineering, and construction (AEC) services in Hong Kong. AECOM's services in Hong Kong include design and planning, project and construction management, environmental consulting, asset management, geotechnical engineering, energy and sustainability consulting, and risk management and safety consulting. AECOM has been involved in many high-profile projects in Hong Kong, including the West Kowloon Cultural District and the Kai Tak Sports Park. AECOM will also introduce either Microsoft or AWS as their digital partner

Industry Contact:

Claudio Trucco (Strategy & Innovations & Digital Lead, AECOM)

Thomas Tang (Executive Director – AECOM)

Project team

Each team will consist of 4 students which play the roles of consultant associate's role to help corporate sponsor as a client to conduct research on the selected problem statement use case. The engagement is 8 weeks and deliverables will be in the form final research proposal and/or report.

Course Intended Learning Outcome (CILO)

T&M Dual-degree Program's Intended Learning Outcomes

1. P-ILO1: Adopt an inter-disciplinary approach to tackle complex real-world problems
2. P-ILO2: Communicate effectively with people of different levels and work areas
3. P-ILO3: Transfer acquired knowledge to meet changes and challenges in different fields
4. P-ILO4: Engage in activities that lead to impact of social improvement
5. P-ILO5: Have the ability to create and innovate with divergent thinking
6. P-ILO6: Be able to apply technical and business skills in an integrated manner in problem-solving
7. P-ILO7: Be a leader in the field of technology management and innovation, and entrepreneurship

TEMG4940 Course Intended Learning Outcomes

1. Acquire insight into project sponsor's organization and empathy with their challenges (P-ILO3)
2. Become familiar with technology trends relevant to this industry sector and overall landscape (PILO1, P-ILO4)
3. Gain confidence to apply problem solving techniques covered in the course (P-ILO1, P-ILO5, PILO6)
4. Improve professional communication in writing and public speaking (P-ILO2, P-ILO7)
5. Improve teamwork across cultures, age and disciplines (P-ILO5)

Course Grading Policy

The course grade consists of both class discussions, mid-term assessment and final written assessment in the form of the business proposal. Participation will be judged based on the student's attendance, contribution to class discussions and group project work.

Assessment Method	Description	Weight (%)
Class participation	Attendance	5%
Discussion	Individual contribution to discussion (Group)	5%
Assignments	Homework assignments designed for background learning and online Canvas quizzes	30%
Final Proposal	Final Proposal / Final Solution prototype	40%
Peer Assessment	Anonymous performance feedback per team by teammates	10%
Professional Assessment	Project Sponsor Assessment	10%
Total		100%

Course Schedule (Tentative) 8-weeks – 3 credits

Summer Semester 2024: June 17th to Aug 10th

Saturday	Topics	Briefly outline what this topic will cover (including reading / assignments if available)	Indicate which course ILOs this topic is related to
Jun 22	Introduction	Kick off & housekeeping, Background knowledge and introduction of AECOM project briefing	PILO1, PILO2, PILO3
Jun 29	Engagement	Visit to AECOM office (Weeknight) and Mentor workshop	PILO2, PILO3
Jul 6	Engagement	Background domain knowledge and project research management	PILO1, PILO2, PILO3,
Jul 13	Workshop	Training by Microsoft or AWS on digital tools	PILO4, PILO5
Jul 20	Workshop	Research, coding, prototyping, case writing	PILO5,
Jul 27	Review	Team review and alignment with AECOM	PILO5, PILO6
Aug 3	Review	Team review and alignment with AECOM	PILO6
Aug 10	Presentation	Practice (Fri) and Final Proposal Presentation (Sat)	PILO6, PILO7

Note: Visit to AECOM office with project mentors will be on a weeknight

Recommended Reading / Reference:

Lo, J. T. Y., & Kam, C. (2021). Innovation performance indicators for architecture, engineering and construction organization. *Sustainability*, 13(16), 9038.

Royan, F. (2021). Digital Sustainability: The Path to Net Zero for Design & Manufacturing and Architecture, Engineering, & Construction (AEC) Industries. *A Frost & Sullivan White Paper, FS_WP_Autodesk_Digital Sustainability*.

HKUST Smart Campus Project 1 - Digital Twin project - <https://digitaltwin.hkust.edu.hk/>

HKUST BIPV Smart Campus Project 2 – Smart Façade BIPV
<https://ssc.hkust.edu.hk/projects/protecting-our-scarce-resources/smart-building-integrated-photovoltaic-systems-toward-zero>