THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY | HKUST Summer School

MECH 4000T – Mechatronics Challenge: Designing and Prototyping with AI

School:	**School of Engineering**
Subject Area:	**Mechanical and Aerospace Engineering**
Course Credit:	**3**
Instructor:	**LEUNG Yun Yuen**
Pre-requisite/co-requisite:	**Nil**

Notes:

- The syllabi provided here is for reference only and may be subject to changes and adjustments as determined by the course instructors.

The Hong Kong University of Science and Technology

Summer 2025/26

MECH4000T "Mechatronic Challenge: Designing and Prototyping with AI"

Course Credits: 3

Pre-/co-requisites: NIL

Course Instructor: Dr. Stanley Leung

Email: yunyuen@ust.hk

Office Hours: TBA

Course Description

This course is designed for the curious student, the hands-on maker, and the aspiring engineer who wants to build the skills that will define the future of technology. No extensive background in theories is required, just a passion for creating and problem-solving. You and your team will brainstorm a unique, Arduino-powered device, design its custom enclosure using industry-standard CAD software like SolidWorks, and use motion simulation tools to test its work mechanism before it even exists. You'll then bring your digital design into the physical world through 3D printing and assemble a fully functional prototype for a final head-to-head competition.

What makes this course unique is your "AI Teammate." You won't just be told about AI; you will learn the art of collaborating with it. You'll practice prompt engineering to unlock creative ideas and accelerate technical work. More importantly, you will learn the essential skill of critically evaluating AI-generated content, validating its suggestions, and making the final engineering judgments yourself.

The course culminates in an exciting, high-energy Gadget Competition where you'll put your creation to the test. You'll pitch your final design, explain your innovation journey, and demonstrate the real-world skills you've acquired.

Intended Learning Outcomes (ILOs)

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

1. Explain and apply iterative Design-Build-Test methodology to engineering prototypes.

2. Integrate mechanics, electronics, and mechatronic components using industry-standard tools.

3. Collaborate with and critically evaluate Generative AI tools, documenting both useful and misleading outputs.

4. Work effectively as a team member, communicating and reflecting on project development.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Project log sheets	20%	at the end of week 2 and week 3
Project presentations	50%	
Performance of the final device	30%	

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Project log sheets	ILO1, ILO2, ILO3	This task assesses students' ability to document project ideas, AI interactions, design (ILO 1), testing results (ILO 2), and team discussion (ILO 3, ILO 4).
Project presentations	ILO1, ILO2, ILO3, ILO4	The presentation and reflection assess students' ability to apply the design method (ILO 1) and refine the design through testing result analysis and identify the problems (ILO 2, IOL 3, IOL 4), demonstrating the understanding of design cycles.
Performance of the final device	ILO1, ILO2, ILO3, ILO4	The demonstration of the final device assesses students' ability apply their learning and teamwork (ILO 3, ILO4) to build and test the prototype (ILO2).

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Outstanding grasp, creative solutions, proactive teamwork.
B	Good Performance	Solid understanding, good problem-solving, reliable collaboration.
C	Satisfactory Performance	Satisfactory performance, meets project basics.
D	Marginal Pass	Marginal pass, meets minimum standards.
F	Fail	Insufficient understanding or effort.

Course AI Policy

This course will learn the art of collaborating with Generative AI tools. You'll practice prompt engineering to unlock creative ideas and accelerate technical work. More importantly, you will learn the essential skill of critically evaluating AI-generated content, validating its suggestions, and making the final engineering judgments yourself.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include [specific details, e.g., strengths, areas for 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

Course materials will be distributed through Canvas

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.

Course Schedule:

Week 1: Foundations & AI-Powered Ideation

- **Day 1:** Intro to the Challenge & CAD Basics. Students get a hands-on introduction to SolidWorks, learning fundamental sketching and part modelling.
- **Day 2:** Intro to Mechatronics. Students learn the basics of Arduino, breadboarding, and simple circuits. They'll get an LED to blink and a motor to turn.
- **Day 3: Meet Your AI Teammate.** A workshop on "Collaborating with AI." Teams are formed and use their AI teammate to brainstorm 10 different ideas for their competition gadget. They must then pitch their top idea to the class.

Week 2: Digital Design & Virtual Testing

- **Day 1:** Hands-on CAD. Teams design the custom 3D-printed chassis or enclosure for their gadget in SolidWorks.
- **Day 2:** Hands-on Simulation (FEM). We'll introduce basic Finite Element Method. Teams will run a simple stress analysis on their enclosure design to ensure it's robust enough for the competition.
- **Day 3:** AI-Assisted Coding. Teams work on programming their gadget in the Arduino environment. The focus is on using their AI teammate to help debug code, explain programming concepts, and suggest logic structures.

Week 3: Prototyping & Integration

- **Day 1:** Hands-on 3D Printing. Students learn to use slicing software and prepare their CAD models for printing. They will start the prints for their final designs.
- **Day 2:** Physical Assembly. The electronics meet the 3D-printed parts! This day is all about hardware integration, troubleshooting, and getting the gadgets to work.
- **Day 3:** Critical AI Verification. A key session where teams must present one example of a "hallucination" their AI teammate produced (and how they caught it) and one example of a genuinely helpful shortcut the AI provided.

Week 4: Refinement & The Final Competition

- **Day 1:** Testing & Tuning. Teams test their gadgets, refine their code, and make last-minute modifications for a competitive edge.

- **Day 2:** The AR Showcase. Students learn to create an Augmented Reality presentation of their gadget using the Reality Composer workflow, allowing them to showcase their design in a futuristic way.
- **Day 3: Competition Day!** The gadgets go head-to-head in the final competition. Teams give a final presentation on their design journey, highlighting their CAD, simulation, and how they successfully collaborated with their AI virtual teammate.