The Hong Kong University of Science and Technology

UG Course Syllabus Template

[Course Title] Community Service Project: Underwater Robot Community Engagement Project

[Course Code] ENGG2900D/SCIE1090D/SBMT2100H (co-listed)

[No. of Credits] 2

[Any pre-/co-requisites] N/A

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Course Description

This project-based course invites undergraduate students to immerse themselves in the dynamic field of underwater robotics, fostering the development of essential 21st-century skills. Through collaborative teamwork, students from diverse academic backgrounds—such as Engineering (SENG), Science (SSCI), and Business Management (SBM)—will engage with identified community groups, including primary and secondary school students and South Asian youth.

Throughout the course, participants will gain hands-on experience in designing and building underwater robots, applying theoretical concepts from STEM education in a practical context. Students will learn to create engaging teaching and training materials, enabling them to effectively transfer their knowledge and skills to others, thereby enriching the learning experience of their community partners.

Moreover, the course emphasizes the importance of inclusivity, encouraging students to understand and support peers with special educational needs. By actively participating in team discussions and decision-making processes, students will cultivate essential soft skills such as communication, collaboration, and critical thinking.

At the culmination of the project, students will present their work through both PowerPoint summaries and reflective written pieces, allowing them to articulate their learning journey and insights. This course not only prepares students to excel in the field of underwater robotics but also equips them with life-long skills that transcend disciplinary boundaries.

The learning goals and objectives for students enrolled in this project are:

- To learn the basic skills of building underwater robots with high school STEM knowledge
- To practice how to transfer robotic skills to the community as Tutors/Assistants in workshop/game day
- To understand the students who are essential to have special education needs.
- To participate actively in team discussions and decision-making
- To present the work in both power point summary and self-reflective written forms at the end of the project.

Intended Learning Outcomes (ILOs)

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

1. State what STEM education is

2. Recognize what the 21st century skills are
3. Understand the core teaching subject (the underwater robotics)
4. Learn how to create related teaching/training materials/games
5. Have intellectual thinking outside the respective discipline.

Assessment and Grading

This is a two-credit course, graded Pass or Fail.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Idea presentation	10%	28/02/2026
prototype	10%	15/03/2026
Community Service (rehearsal)	20%	28/03/2026
Workshop Training material	20%	02/05/2026
Underwater Robot Competition	20%	02/05/2026
Project closing and Self-reflective report	20%	06/06/2026

* 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
Idea Presentation	ILO1, ILO2, ILO3	In this task, students will present innovative ideas for teaching underwater robotics (ILO3) while integrating key concepts of STEM education (ILO1). This process will also enable students to identify and articulate their 21st-century skills (ILO2).
Prototype	ILO2, ILO3, ILO4	Students will collaborate to design and build a prototype of an underwater robot. This task emphasizes the application of their 21st-century skills (ILO2) and deepens their understanding of underwater robotics (ILO3) while developing effective teaching/training materials (ILO4).
Community Service (rehearsal)	ILO2, ILO3, ILO5	Through rehearsals for community service, students will practice their soft skills (ILO2) while teaching underwater robotics concepts (ILO3) and engaging in intellectual thinking beyond their specific disciplines (ILO5).
Workshop Training material	ILO2, ILO3, ILO4, ILO5	In this task, students will refine their workshop training materials (ILO4) and enhance their teaching strategies (ILO3) through the application of

		higher-order thinking skills (ILO5) and soft skills (ILO2).
Underwater Robot Competition	ILO2, ILO3, ILO4, ILO5	During the underwater robot competition, students will showcase their prototypes (ILO3, ILO4) and apply their soft skills (ILO2) in a practical community service context, fostering intellectual engagement (ILO5).
Project closing and Self-reflective report	ILO1, ILO2, ILO5	In the final project closing session, students will summarize their key learnings as a group (ILO1, ILO2) and write individual self-reflective reports to evaluate their overall experiences and insights gained throughout the project (ILO5).

Grading Rubrics

Rubric for Summative Assessment

Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs Improvement (1)**
Understanding of STEM Concepts	Demonstrates a comprehensive understanding of STEM concepts and effectively integrates them into presentations and materials.	Shows a good understanding of STEM concepts with some integration into presentations and materials.	Displays a basic understanding of STEM concepts but lacks clear integration.	Limited understanding of STEM concepts; integration is minimal or absent.
Creativity and Innovation	Exhibits exceptional creativity and innovation in ideas and prototype design; ideas are original and well-developed.	Displays creativity and innovation; ideas are mostly original with some development.	Shows some creativity; ideas may be conventional or underdeveloped.	Lacks creativity; ideas are not original or poorly developed.
Collaboration and Teamwork	Actively engages in collaboration, demonstrating leadership and strong interpersonal skills; effectively facilitates group discussions.	Participates well in collaboration, contributing positively to group dynamics; engages in discussions.	Participates in collaboration but may not contribute significantly; limited engagement in discussions.	Rarely participates in collaboration; does not engage with team members.
Quality of Teaching Materials	Produces high-quality, well-organized, and engaging teaching materials that effectively support learning objectives.	Produces good quality teaching materials that are organized and mostly support learning objectives.	Produces satisfactory teaching materials that may lack organization or engagement.	Produces poor quality teaching materials that do not support learning objectives.
Presentation Skills	Delivers a clear, engaging, and well-structured	Delivers a mostly clear and structured presentation;	Delivers a presentation that is somewhat clear	Delivers a poorly structured presentation; fails

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
	presentation; effectively communicates ideas and engages the audience.	communicates ideas adequately but may lack engagement.	but lacks structure or engagement.	to communicate ideas effectively.
Self-Reflection	Provides a thoughtful and insightful self-reflective report that demonstrates deep learning and personal growth throughout the project.	Provides a good self-reflective report that shows some learning and personal growth.	Provides a basic self-reflective report that lacks depth in learning and personal growth.	Provides a limited self-reflective report that does not demonstrate learning or personal growth.

Final Grade Descriptors:

Total Score: Each criterion is scored from 1 to 4, with a maximum possible score of 24.
Interpretation of Scores:

- 21-24: Excellent understanding and execution of project components.
- 16-20: Good understanding and execution with minor areas for improvement.
- 11-15: Satisfactory understanding and execution; several areas need improvement.
- 6-10: Needs significant improvement; lacks understanding and execution of project components.

Remarks: Students' final scores above 10 can have a "Pass".

Course AI Policy

Students are welcome to use AI as a companion to generate their creative idea for the community service teaching.

Communication and Feedback

Formative assessment and feedback will be communicated to teams through email groups to let students further understand their progress and react with their improvement, while its summative assessment will be communicated via SIS system.

Resubmission Policy

Any late submissions of the task assessments should be applied with an official application. Other penalties will be imposed when the late submission is found without any official application.

Required Texts and Materials

Book

- Underwater Robotics: Science, Design and Fabrication (by Marine Advanced Technology Education, 1st Edition, 2010)

Papers

- Yim, T. S., Woo, K. T., & Chin, L. T. (2024, May). Promoting Inclusive Education through Virtual Underwater Robotics Experience: Enhancing STEM Learning and Collaboration with Real-World Applications. In 2024 IEEE Global Engineering Education Conference (EDUCON) (pp. 1-5). IEEE.

- Yim, T. S., Woo, K. T., & Chin, L. T. (2024, May). Promoting Inclusive Education through Virtual Underwater Robotics Experience: Enhancing STEM Learning and Collaboration with Real-World Applications. In 2024 IEEE Global Engineering Education Conference (EDUCON) (pp. 1-5). IEEE.
- Catlin, D., & Blamires, M. (2019). Designing robots for special needs education. Technology, knowledge and learning, 24(2), 291-313.
- Chavez, A. G., Ranieri, A., Chiarella, D., & Birk, A. (2021). Underwater vision-based gesture recognition: A robustness validation for safe human–robot interaction. IEEE Robotics & Automation Magazine, 28(3), 67-78.
- Sik-Lanyi, C., & Ara, J. (2022, July). Serious and Fun Games: Introduction to the Special Thematic Session. In International Conference on Computers Helping People with Special Needs (pp. 67-72). Cham: Springer International Publishing.
- Rifandi, R., & Rahmi, Y. L. (2019, October). STEM education to fulfil the 21st century demand: a literature review. In Journal of Physics: Conference Series (Vol. 1317, No. 1, p. 012208). IOP Publishing.

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.

[Optional] Additional Resources

N/A