

PUSAT PENGAJIAN KEJURUTERAAN AWAM UNIVERSITI TEKNOLOGI MARA CAWANGAN PULAU PINANG



FUN AND HANDS-ON LEARNING WITH CDIO IMPLEMENTATION OF CDIO IN FLUID MECHANICS (BUOYANCY & STABILITY)

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Buoyancy and Stability plays a crucial role in designing floating structures such as ships, boats, and pontoons. They are not easy concepts to grasp, but CDIO helps students understand them better because it emphasizes hands-on learning, real-world application and problem-solving.

The CDIO assignment given to students in alternate semesters is based on the same topic but differs in the materials used and what needs to be constructed. The students were given the task of:

- 1) making a raft out of ice-cream sticks (semester Oct'23-Feb'24)
- 2) making a boat using plastic straws (semester Oct'24-Feb'25)

The assignment was a group-based, with a maximum of four members and must be completed within a week. The process involved brainstorming, designing, analyzing, testing and evaluating buoyancy and stability principles using theoretical and experimental data.

C – Conceive: Brainstorming and Planning

- 1) Students formed groups and brainstormed ideas on how to construct a raft that can float while maintaining stability and able to support a load of 100 g (semester Oct'23-Feb'24)
- 2) Students formed groups and brainstormed ideas on how to construct a boat that can float while maintaining stability and able to support a load of 150 g (semester Oct'24-Feb'25)

The students had to understand the Archimedes' Principle and analyze stability factors. Each group had to develop a work plan and draw a flowchart indicating the processes needed to complete the task.

D – Design: Structural Design and Theoretical Analysis

The groups then proceeded with detailed design, including sketching the object, included a Free Body Diagram to analyze forces on the object, as well as equations and calculations involved.

I – Implement: Building and Testing of Models

The raft/boat models were then tested in a water tank, held at the Hydraulics Laboratory. Observations include the floating capability and stability when weight was added. The depth of immersion was recorded each time weight was added, till the raft/boat capsized.

O – Operate: Evaluation and Discussion

Finally, the groups compared their theoretical and experimental results, analyzed the discrepancies between the expected and actual performance, discussed stability issues or design limitations and suggested possible improvements.

By applying the CDIO framework to Fluid Mechanics, students gain hands-on experience with buoyancy and stability. These assignments enhanced problem-solving skills, encouraged teamwork and strengthened their practical understanding of fundamental engineering principles. Overall, as an educator who observed these processes, I can say that the students really had a great time doing these assignments, especially when it comes to testing their models.

Semester Oct'23-Feb'24
Task: Making a raft out of ice-cream sticks



Semester Oct'24-Feb'25
Task: Making a boat using plastic straws

