MECHANICAL DESIGN COMPETITION

Preliminary

GUIDEBOOK

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ABOUT US

Himpunan Mahasiswa Mesin Universitas Diponegoro is a student organization that serves as a platform for Mechanical Engineering students to grow through **academic development, leadership, innovation, and collaboration.**

As part of the **Department of Mechanical Engineering**, HMM Undip supports programs that strengthen **engineering knowledge, student creativity, and professional character.**

Through **Mech-ONE**, HMM Undip brings a new initiative to connect **students, academics, industry stakeholders, and young innovators** in one collaborative platform.

Driven by engineering.
Built through collaboration.
Committed to future innovation.

ABOUT
Mech-ONE

Mech-ONE 2026 or **Mechanical Engineering Competition – Open National and International Event** is a national and international-scale program initiated by Himpunan Mahasiswa Mesin Universitas Diponegoro.

THEME

"Advancing Renewable Energy Technologies for a Sustainable and Resilient Future,"

Mech-ONE is designed as a platform for students to **develop ideas, designs, and solutions** in renewable energy, mechanical engineering, and sustainable business.

Mech-ONE CONSISTS OF
THREE MAIN PROGRAMS

01

Mechanical Design Competition

Ocean renewable energy engineering design challenge.

02

Business Plan Competition

Renewable energy business solutions for coastal sustainability.

03

National Seminar

A national forum for knowledge sharing, discussion, and appreciation.

BACKGROUND
OF THE EVENT

The transition toward **renewable energy** has become one of the most important movements in shaping a **cleaner and more resilient future.** As global energy challenges continue to grow, **innovation** is needed not only in technology, but also in the way ideas are designed, developed, and implemented.

At the same time, **coastal areas** such as Semarang face real environmental challenges, including **tidal flooding, land subsidence, waste issues**, and the need for more adaptive infrastructure. These conditions require solutions that combine **engineering, sustainability, and practical implementation.**

Mech-ONE is created as a response to that challenge. Through **mechanical design, sustainable business planning, and national discussion**, this event encourages students to transform **coastal and energy problems** into **future-oriented solutions.**

Where engineering minds turn energy challenges into future solutions.

MECHANICAL DESIGN COMPETITION

This competition focuses on developing innovative engineering designs for **ocean renewable energy systems**. Participants will analyze technical problems and create practical mechanical solutions. Our theme:

“Ocean Renewable Energy Engineering”

BACKGROUND

Ocean renewable energy is increasingly recognized as a key contributor to the future of sustainable energy systems. With vast and continuously available marine resources, technologies that harness wave, tidal, and offshore renewable energy have the potential to provide reliable solutions for energy generation, freshwater production, and sustainable coastal development.

However, significant engineering challenges remain in designing systems that are efficient, reliable, economically viable, and capable of operating in harsh marine environments. Addressing these challenges requires innovative approaches that integrate mechanical design, energy conversion, structural integrity, sustainability, and practical implementation.

This competition provides a platform for participants to develop cutting-edge engineering solutions that explore the potential of ocean renewable energy while addressing real-world challenges through creativity, innovation, and technical excellence.

WHY YOU SHOULD JOIN?

1. **ENGINEERING IMPACT THROUGH INNOVATION**
   Transform real-world ocean energy challenges into innovative engineering solutions that create tangible benefits for coastal communities and sustainable development.
2. **REAL-WORLD DESIGN CHALLENGE**
   Experience the complete engineering design cycle inspired by real industrial challenges, from conceptualization and system integration to technical evaluation.
3. **ADVANCED ENGINEERING THINKING**
   Strengthen your ability to analyze complex engineering systems, optimize design performance, and make data-driven technical decisions.
4. **GLOBAL PROFESSIONAL NETWORK**
   Engage with future engineers, researchers, and industry experts while expanding your professional network beyond academic boundaries.
5. **COMPETITIVE ENGINEERING PORTFOLIO**
   Showcase your technical expertise through a high-impact project that demonstrates innovation, feasibility, and engineering excellence.

IMPACT DIRECTION

Shaping the Future of Sustainable Ocean Engineering

Inspiring the next generation of engineers to develop transformative technologies that advance renewable energy utilization, freshwater accessibility, and resilient coastal infrastructure.

WINNER PRIZE POOL

1ST PLACE
IDR 2.500.000
+ Merchandise and Certificate

2ND PLACE
IDR 1.500.000
+ Merchandise and Certificate

3RD PLACE
IDR 1.000.000
+ Merchandise and Certificate

Best Poster
IDR 500.000
+ Certificate

Total Prize Pool: IDR 5.500.000

Competition Flow

This competition consists of two main stages designed to evaluate the quality of participant's ideas, the depth of their analysis, and their ability to present comprehensive solutions.

PRELIMINARY PHASE

In the Preliminary Phase, each team is required to submit a **comprehensive engineering design proposal** based on the competition theme. The proposal must clearly present the problem analysis, design objectives, conceptual design, system working principles, engineering calculations, technical feasibility, and implementation considerations.

Participants are expected to develop innovative mechanical design solutions that utilize ocean renewable energy to address real-world challenges in freshwater production and sustainable energy generation for coastal and remote island communities.

All submissions will be evaluated by a panel of judges based on design innovation, engineering feasibility, design analysis, sustainability, manufacturability, and the overall quality of the proposed solution.

The top 8 teams based on the proposal evaluation results will advance to the final stage.

FINAL PHASE

Participants who pass the selection process will present their proposals before a panel of judges. They will be evaluated based on their proposal quality, presentation, analysis, and ability to defend their ideas. Only 8 teams will advance to the final stage of the competition.

In addition to the **presentation** and **presentation slides**, participants are also required to submit a **poster** as one of the competition outputs.

The judging will also consider the implementation potential, solution impact, and business strategy before determining the final winner.

TIMELINE

PRELIMINARY PHASE

	KEY DATES	AGENDA	LOCATION
PRELIMINARY	31 May– 28 June	First Batch Registration	Online by Web
	29 June – 28 July	Second Batch Registration	Online by Web
	2 August	Deadline Submit Work	Online by Web
	28 August	Announcement of Finalists	Online by Web/Instagram

FINAL PHASE

	KEY DATES	AGENDA	LOCATION
FINAL	28 -30 August	Finalists Registration	Online by Web
	28 August - 6 September	Collection of Finalists Posters	Online by Web
	28 August - 24 September	PPT Collection	Online by Web
	22 - 23 September	Technical Meeting	Online
	26 September	Final Presentation	Offline, Undip Tembalang
	26 September	Awarding	Offline, Undip Tembalang

***International participants** are allowed to conduct their **final presentation online**.*

General Rules

1. **Participant Status:** Participants must be active students enrolled in D3/D4/S1 programs, proven by a valid Student Identification Card (KTM) or official proof of active student status.
2. **Team Members:** Each team consists minimum of **3 (three)** and maximum of 5 (five) members from the same university.
3. **University Quota:** Each university is allowed to send more than one team.
4. **Team Leader:** Each team must appoint one member as the Team Leader who will serve as the main correspondent with the committee.
5. **Submission Limit:** Each team is only allowed to submit one work.
6. **Work Originality:** All submissions must be original, unpublished, and must not have been previously competed for or won any awards in other competitions.
7. **Theme Alignment:** The submitted work must align with the main theme and one of the predetermined subthemes.
8. **Language & Content:** The Proposal, Poster, and Presentation Deck (PPT) must be written in proper English and must not contain any SARA (ethnicity, religion, race, or intergroup sentiments) or offensive elements.
9. **Stage Mechanism:** The preliminary stage is conducted online, while the final stage is conducted offline at Universitas Diponegoro. Teams that qualify for the final stage must attend the Technical Meeting.
10. **Information Changes:** Any changes to the regulations or new announcements will be delivered during the Technical Meeting and officially communicated via the WhatsApp group and the team leader's email.
11. **Violation Sanctions:** Violation of the rules, predetermined formats, or late submission of files can cause points reduction or even disqualification from the competition.
12. **Judges' Decision:** The decision given by the judges during the competition is absolute and cannot be contested under any circumstance.

MECHANICAL DESIGN COMPETITION

PROBLEM STATEMENT

Access to clean water remains a significant challenge for many remote islands and coastal communities worldwide. Due to their geographical isolation, these regions often face limited freshwater resources, high transportation costs, and dependence on centralized infrastructure that is difficult to construct and maintain.

At the same time, ocean renewable energy represents a continuously available resource with the potential to support decentralized freshwater production systems. However, developing a reliable ocean-based desalination platform presents numerous engineering challenges. Such systems must operate under dynamic marine conditions, withstand long-term exposure to harsh environments, maintain operational reliability, and minimize ecological impacts while delivering a sustainable supply of freshwater.

Participants are challenged to develop an innovative Integrated Wave Energy System (IWES) capable of utilizing ocean wave energy to support seawater desalination and freshwater production for remote island communities. The proposed design should demonstrate technical feasibility, operational reliability, environmental responsibility, and long-term sustainability while addressing the practical challenges associated with offshore deployment.

The need for sustainable freshwater solutions in remote and underserved regions presents a significant engineering challenge. Ocean wave energy offers a promising opportunity to support decentralized desalination systems capable of providing reliable access to clean water without dependence on conventional infrastructure or fossil fuels.

Therefore, participants are challenged to develop an innovative Integrated Wave Energy System (IWES) that efficiently harnesses ocean wave energy to produce freshwater through desalination. The proposed solution should demonstrate technical feasibility, operational reliability, environmental responsibility, and long-term sustainability while addressing the practical challenges of deployment in marine environments.

MECHANICAL DESIGN COMPETITION

DESIGN CONSIDERATIONS

To ensure the practicality and sustainability of the proposed solution, participants are encouraged to consider the following engineering and environmental factors during the design process:

Marine Ecosystem Protection

The system should minimize disturbances to marine habitats and biodiversity. Design decisions should consider the potential impacts on marine fauna, migration pathways, and local ecosystems.

Low-Wave Energy Conditions

Ocean wave conditions are highly variable. The proposed system should demonstrate the ability to operate effectively and maintain energy production during periods of low wave activity.

Reliability and Fail-Safe Operation

Participants should consider potential failure scenarios and propose strategies to maintain system functionality, reduce downtime, and ensure operational resilience.

Maintenance and Accessibility

Since deployment may occur in remote locations, the system should facilitate inspection, maintenance, repair, and component replacement while minimizing operational costs.

Freshwater Distribution Strategy

Participants should develop an effective method for delivering freshwater from the offshore system to the target community, considering efficiency, practicality, and long-term operation.

Environmental Sustainability

The design should prioritize sustainable operation, responsible material selection, and minimal environmental impact throughout its service life.

Structural Durability

The system must withstand marine conditions such as corrosion, wave loading, currents, and long-term fatigue while maintaining structural integrity through the selection of appropriate materials.

Scalability and Future Development

Participants are encouraged to explore modular or scalable solutions that can be adapted to different deployment scenarios and future community needs.

MECHANICAL DESIGN COMPETITION

METOCEAN DATA & CONDITIONS

Introduction

A strategic maritime asset located in an open-water corridor within a remote archipelago. This location is characterized by extremely strong ocean currents and consistent water flow patterns, making it a critical site with abundant hydrokinetic energy potential. While it holds great potential for wave energy harvesting for self-sustaining desalination systems, the area presents dynamic environmental challenges to the operational stability of offshore structures.

Wind

Winds in this region are strongly influenced by tropical atmospheric dynamics, with wind speeds generally ranging from 0 to 45 km/h. Wind flow is dominated by movements from the southeast (SE), consistent with regional monsoon patterns. The majority of strong wind events occur within the 10 to 30 km/h range, resulting in consistently moderate wind loads on the surface components of the IWES system. The most critical wind pressure analysis typically occurs during the early-year period, when wind speeds reach their peak.

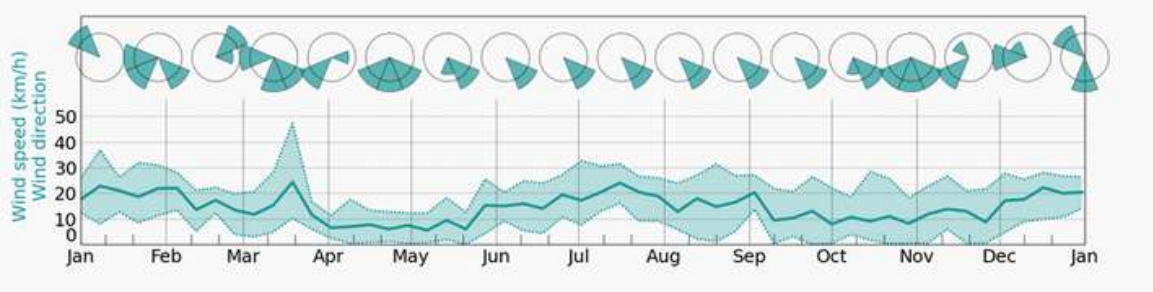

Figure 01. Meteoblue Data-Field-DRS One Year Wind Speed

Waves

Wave conditions at the operational site are influenced by monsoon circulation, which is divided into a wet season, a dry season, and two transitional periods. During certain periods, strong winds generate higher waves due to the long fetch from the open ocean. The average Significant Wave Height (SWH) ranges from 0.5 meters to 1.5 meters, with a maximum wave height of up to 2.5 meters under extreme weather conditions. Participants must account for these variations in wave height when designing the energy conversion efficiency of the buoy system.

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Water Depth

The average water depth is approximately 10 meters below sea level.

Climate

Precipitation data for this region show a distinct tropical rainfall pattern throughout the year. Significant rainy seasons generally occur early in the year, characterized by high rainfall intensity that requires specialized drainage systems on the platform. Meanwhile, a stable dry season occurs in the middle of the year with a drastic increase in the number of dry days. The IWES platform design must be resilient to continuous humidity and capable of handling high-intensity stormwater runoff to protect the electrical systems.

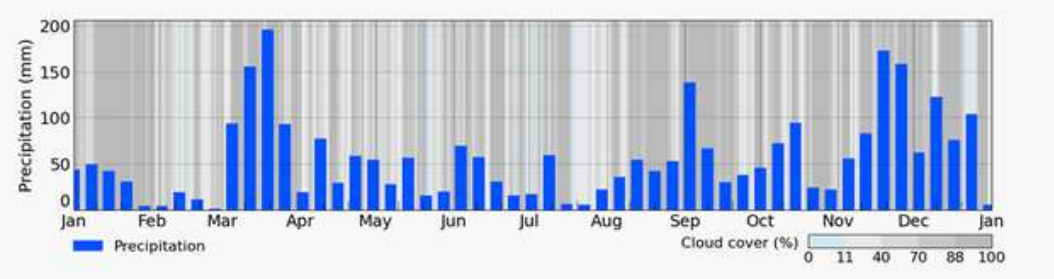


Figure 02. Meteoblue Data-Precipitation amounts

Temperature

The operational area has a tropical climate with minimal annual temperature fluctuations. Average monthly maximum temperatures remain stable within a range of 27°C to 29°C, highest daily temperature can reach nearly 29.5°C during the period from May to June. In addition to warm air temperatures, the area has high relative humidity year-round, remaining stable between 70% and 90%. due to high ambient temperatures and continuous exposure to solar heat, participants are advised to consider thermal management for desalination units and hybrid energy systems to ensure they continue to operate at optimal efficiency.

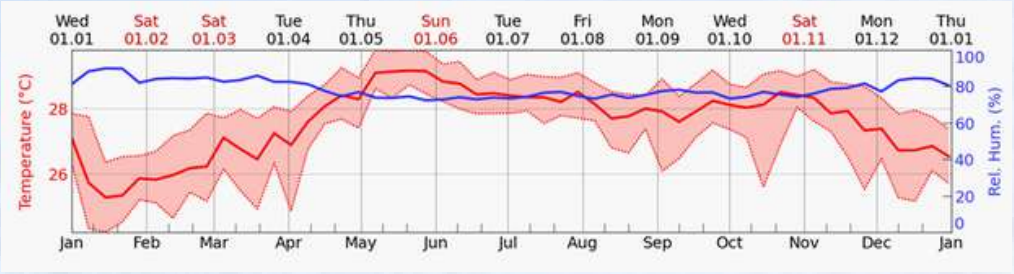
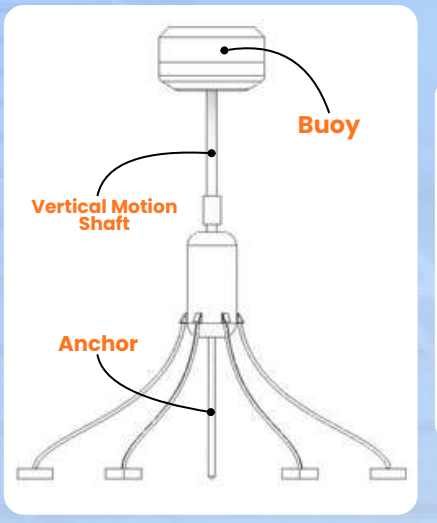


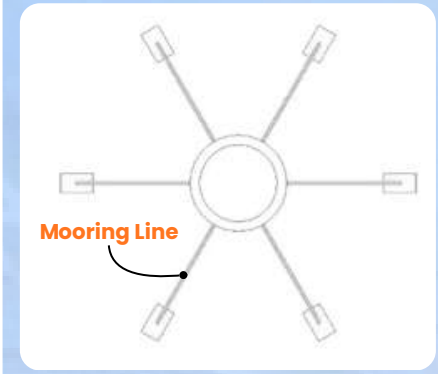
Figure 03. Meteoblue Data-Average Temperature

MECHANICAL DESIGN COMPETITION

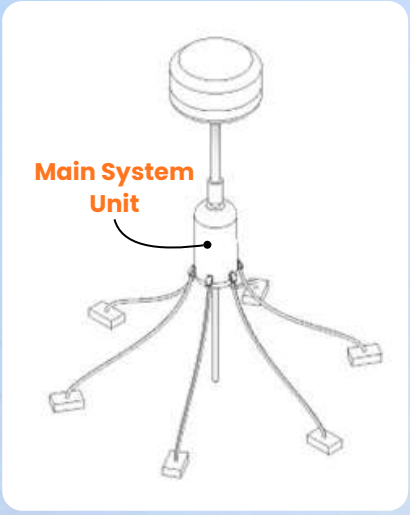
DESIGN REFERENCE



FRONT VIEW



TOP VIEW



ISOMETRIC VIEW

Description

The Design Reference is provided as a conceptual illustration to help participants understand the overall system configuration, operating environment, and design objectives of the competition. It serves as a visual representation of a wave-powered buoy system that utilizes ocean renewable energy for freshwater production and energy generation.

The reference design demonstrates the fundamental components of the system, including the floating buoy, energy conversion unit, structural support system, and mooring arrangement. However, it is intended solely as an example of the design direction and should not be interpreted as the required final solution.

Participants are encouraged to develop their own innovative concepts, configurations, mechanisms, and system architectures. Modifications to the buoy geometry, energy conversion mechanism, desalination configuration, structural arrangement, and distribution system are permitted, provided that the proposed design fulfills the competition objectives and demonstrates sound engineering principles.

The evaluation process will prioritize innovation, technical feasibility, engineering analysis, sustainability, and practicality rather than similarity to the provided Design Reference.

MECHANICAL DESIGN COMPETITION

TASK INSTRUCTION

Design Output

Participants are challenged to develop an innovative mechanical design solution that utilizes ocean renewable energy to address freshwater accessibility and sustainable energy generation in remote coastal and island communities.

The proposed design shall focus on the development of a Wave-Powered Buoy System capable of harnessing ocean wave energy to support freshwater production through desalination and or electricity generation through renewable energy conversion.

Participants are encouraged to develop original engineering concepts that demonstrate innovation, technical feasibility, sustainability, and practicality for real-world implementation.

Design Requirements

Each team shall develop an innovative and functional mechanical system integrated within the **Main System Unit** of the wave-powered buoy. The proposed design must clearly demonstrate how ocean wave energy is captured, converted, transmitted, and utilized to support freshwater production through desalination and or electrical power generation.

The design shall include a well-defined mechanical arrangement consisting of appropriate components, mechanisms, and power transmission systems that work together as an integrated engineering solution.

Participants shall ensure that the proposed design addresses the following engineering requirements:

- Design a mechanism that converts wave motion into usable energy.
- Design the component functional mechanical inside **Main System Unit**
- Develop a clear and functional mechanical system architecture.
- Integrate the system with desalination and electrical power generator.
- Demonstrate technical feasibility and engineering practicality.
- Consider manufacturability, maintenance, and sustainability.
- Preserve reference components and add innovations.

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Design Freedom

Participants are free dimension design of the components to be determined:

- Buoy geometry and configuration.
- Energy conversion mechanisms.
- Desalination system arrangement.
- Structural and mooring system design.
- Freshwater distribution method.
- Energy storage and auxiliary systems.
- Additional innovative features.

Notes:
The Design Reference only illustrates the external configuration of the buoy system. The primary challenge of this competition is the development of the internal mechanical system within the **Main System Unit**. Participants are expected to propose innovative mechanisms, component arrangements, and engineering solutions that enable the system to operate effectively and sustainably.

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Proposal Output

Each team shall submit an Engineering Design Proposal containing the following sections:

1. Executive Summary

Brief overview of the proposed design concept and expected outcomes.

2. Background and Problem Statement

Description of the challenge being addressed and its relevance to coastal and island communities.

3. Design Objectives

Clear explanation of the engineering objectives and design targets.

4. Conceptual Design

Overview of the proposed system, including:

- System architecture
- Working principles
- Main components
- Energy flow diagram

5. Engineering Analysis

The proposal shall include supporting technical analysis, such as:

- Buoyancy and stability analysis (CFD)
- Structural analysis (FEA)
- Energy conversion calculation
- Freshwater production estimation
- Material selection
- Feasibility assessment

6. Innovation and Sustainability

Explanation of the innovative aspects of the design and its sustainability impact.

7. Implementation Considerations

Discussion regarding manufacturability, maintenance, deployment, and operational considerations.

8. Conclusion

Summary of the proposed solution and its expected benefits.

MECHANICAL DESIGN COMPETITION

Submission Format

Participants are required to submit:

CAD Design Package

Format Name: [Team Name]_Preliminary_MDC_DESIGN2026.zip

- All of the designed Parts
- Complete Assembly Model
- Engineering Drawings

Drawings Export to PDF

Format Name: [Team Name]_Preliminary_MDC_DRAWING2026.pdf

Proposal

Format Name: [Team Name]_Preliminary_MDC_PROPOSAL2026.pdf

Registration Flow

Participants are required to complete the registration process through the official website:
https://mech-one-2026-website.vercel.app

The registration process must be carried out only by the team leader.

Each participant is required to do the all of the **registration requirements below:**

1. Student ID Card / Proof of Active Student Status (All Members)
2. Follow @mech.one_undip (All Members)
3. Twibbon Post with Mention and 3 Tagged Friends (Team)
4. Poster Sharing to 3 Social Media Groups (All Members)
5. Instagram Story Mentioning @mech.one_undip (All Members)
6. Upload Compiled Proof of Requirements (PDF/JPG)

Registration and Submission Procedure:

1. **Create an Account and Log In**
   Access the competition website https://mech-one-2026-website.vercel.app , create an account, and log in using the registered credentials.
2. **Complete Your Profile**
   Complete your profile information through the account menu and upload all required documents as specified.
3. **Register the Team**
   Register your team according to the selected competition category by completing the registration form, making the required payment, and uploading the proof of payment.
4. **Access the Case Guidebook**
   Upon successful team registration, participants will gain access to the **Case Guidebook**, which contains the case details, technical requirements, and additional information necessary for preparing the submission.
5. **Submit the Competition Entry**
   Upload and submit the required work/proposal through the submission system before the specified deadline.

*Once the team received the confirmation of registration, the leader is required to join the **WhatsApp group** via the link provided in the **email**.*
Confirmation email will be sent within maximum 2x24 hours after submission.

Preliminary Phase

The output of the first mandatory phase for all participants is **Proposal, CAD Design Package,** and **Drawings**. Each team is required to **register through on website** between 31 May–28 July, with the **submit work Deadline** on 2 August 2026 at 23:59 GMT+7. Failure to submit the Proposal within the specified timeframe will result in the team being disqualified from the competition.

- The proposal must be written in **proper English language**
- Proposal must be submitted with an **originality statement** and **Similarity Index** on the last page

Document Format

- Font type: Times New Roman
- Font size: (Title: 14 Bold) (Subtitle and body: 12)
- Line spacing: 1,5
- Alignment: Justify
- Margin: 3,5(top), 3(bottom, right, left)
- Page number: Bottom right corner
- Paper size: A4
- File format: PDF
- The file name of the proposal can be found in the **submission format**
- **Maximum 10 pages** (excluding cover page, references, appendices, and originality statement).

Content Format

- The Proposal must include, but not limited to:
- The cover page
- Executive summary
- Introduction
- Design Concept & Innovation
- Design Analysis
- Benefits & Sustainability
- Conclusion
- References
- Appendices (required)
- Originality statement
- Maximum Turnitin Similarity Index: **23%** (excluding references and bibliography).
- (The originality statement and proposal template can be accessed below)

Template of Document (Proposal, Originality Statement, twibbon, etc):
https://bit.ly/PRELIMINARYMDCMECHONE2026

Note

- The proposal must remain neutral and unbiased toward any institution, and must not contain any offensive content, discriminatory remarks, or elements related to ethnicity, religion, race, or intergroup sentiments.
- The proposal must be original, free from plagiarism, have not been published on any media platforms, and have not been submitted to or awarded in any previous competitions.
- The proposal that has been submitted can not be revised

Scoring Table

Proposal

Assessment Criteria	Description	Score (%)
Interpretation of Technical Requirements	Assessing the ability to translate case studies into measurable design parameters (force, torque, speed, etc.)	10
Creativity and Originality of the Work	Assessing the extent to which the proposed design is novel, unique, and distinct from existing design	20
Relevance to the Case Study	Assessing the extent to which the designed tool can function effectively in accordance with its intended purpose and provide practical benefits	15
Adherence to Engineering Principles	Assessing the accuracy of the application of engineering theories (mechanics, materials science, thermodynamics, etc.), component selection, and logical basic calculations.	20
Functional Analysis and Output	Assessing the equipment's potential for energy efficiency and the clarity of the performance goals to be achieved.	15
Design Reliability and Durability	Assessing the extent to which the design takes into account operational safety, material durability, and marine environmental considerations.	10
Document and Visual Quality	Evaluating the completeness, neatness, and organization of the proposal document, as well as the quality of visual presentations.	10
Total		100

Design

Assessment Criteria	Description	Score (%)
Level of Complexity	Assessing the level of complexity and innovation in CAD models, in terms of mechanisms, the number of components, and the relationships between parts.	15
Detail Drawing	Evaluating the precision and accuracy in presenting drawing details, such as dimensions, tolerances, annotations, and cutaway sections.	20
Completeness of Drawings	Evaluating the completeness of technical drawings, such as part drawings, assemblies, exploded views, and other technical specifications.	15
Mechanical Realism	Assess the extent to which the CAD model reflects a feasible mechanical system, such as the use of relevant mechanical components, logical and understandable operating mechanisms, and appropriate flow and motion.	20
Assembly and Interference Validation	Evaluating the compatibility of the relationships between components in the assembly, such as the absence of interference between components, the presence of realistic gaps, and the proper fit between parts.	15
Use of Standard Components	When evaluating the use of standard components in the design—such as bolts, nuts, bearings, and other standard components—and ensuring that their dimensions comply with general standards, not all components are custom-made without a clear reason.	5
Design Consistency and Optimization	Evaluating the consistency and efficiency of the design in the CAD model, such as the consistency of component thickness and dimensions, ensuring there is no overdesign or underdesign, and assessing the efficiency of design feature usage.	10
Total		100

PENALTIES

Late Submission

Proposal submissions received after the deadline will be penalized by the point reduction of 10 points per hour. Any submission made more than two (2) hours after the deadline will result in disqualification.

Exceeding Page Limit

Proposal that exceed the page limit will be penalized with a 10 points deduction.

Code of Conduct Violation

Any submission or conduct containing offensive content, discriminatory remarks, or elements related to ethnicity, religion, race, or intergroup sentiments will result in immediate disqualification.

Re-Registration Requirement

Finalists who fail to complete the re-registration process within Three (3) days of the announcement will be disqualified

Final Decision

All decisions made by the judges and organizing committee are final and binding. Further provisions may be determined by the organizing committee if necessary.

STILL CONFUSED?

Feel free to contact the CP from our Mech ONE Admin team.

Contact Person

WHATSAPP:

CP 1: Aldi
No. Whatsapp: 0851-5689-1196

CP 2: Hugo
No. Whatsapp: 0812-5757-8953

Presented by
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Departemen Teknik Mesin
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