# Course Outline

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| **Course title: Physics (I)** | **Instructor name: Jun Albert Pardillo** |
| **Credit units: 3** | **Total hours: 54** |

## Course Description:

Physics (I) is a foundational course designed for first-year mechanical engineering students. This course provides an introduction to the fundamental principles of physics and their applications in mechanical engineering. The course covers topics such as mechanics, thermodynamics, waves, and optics.  
  
Students will learn about the laws of motion, forces, energy, and momentum, and how they apply to mechanical systems. They will also study the behavior of gases, liquids, and solids, and the principles of heat transfer. The course will also cover the properties of waves, including sound and light, and their applications in engineering.  
  
Throughout the course, students will engage in hands-on activities and experiments to reinforce their understanding of the concepts covered. They will also develop problem-solving skills through the application of physics principles to real-world engineering problems.  
  
Upon completion of this course, students will have a solid foundation in physics and be able to apply their knowledge to the design and analysis of mechanical systems. They will also be prepared for further study in advanced physics courses and their applications in mechanical engineering.

## Course Learning Outcomes (CLOs)

* Understand and apply the fundamental principles of mechanics, thermodynamics, waves, and optics in the context of mechanical engineering.
* Develop analytical and problem-solving skills to address real-world mechanical engineering challenges.
* Conduct experiments and interpret data to reinforce theoretical knowledge and its application to mechanical systems.
* Apply physics principles to the design, analysis, and improvement of mechanical systems.

## Topics / Modules and Intended Learning Outcomes

1. Introduction to Mechanics in Mechanical Engineering

* Explain the fundamental principles of mechanics and fluid dynamics and their importance in the history and development of mechanical engineering.
* Develop an analytical approach to solving problems related to dynamics and mechanics in mechanical systems.

1. Principles of Thermodynamics for Engineers

* Describe the principles of thermodynamics, including heat transfer and energy conservation, and their applications in mechanical engineering.
* Analyze thermodynamic systems and processes, understanding the interdependence of the first and second laws of thermodynamics.

1. Understanding Forces and Energy in Mechanical Systems

* Apply Newton's laws of motion to analyze the forces and energy within mechanical systems.
* Evaluate the motion and stability of mechanical systems under various force fields.

1. Behavior of Gases, Liquids, and Solids in Engineering

* Understand the behavior and properties of gases, liquids, and solids and their implications in mechanical engineering applications.
* Implement active learning strategies to explore the behavior of materials under different conditions.

1. Waves and Optics Applications in Engineering

* Explore the principles of waves and optics and their applications in engineering, including the use of matrices in problem-solving.
* Review optical methods used in engineering applications, such as contactless torque sensors, and understand their importance in mechanical engineering.

## Weekly Activities

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| **Week No.** | **Topic** | **Activity Description** | **Expected Output** | **Assessment Tools** |
| Week 1 | **Introduction to Mechanics in Mechanical Engineering** | Lecture on the history and development of mechanics in mechanical engineering. Introduction to basic principles of mechanics and fluid dynamics. | Students will complete a quiz to assess their understanding of the fundamental principles of mechanics. | Quiz |
| Week 2 | **Introduction to Mechanics in Mechanical Engineering** | Problem-solving session focusing on dynamics and mechanics in mechanical systems. | Students will solve a set of problems related to dynamics and mechanics in mechanical systems. | Problem Set |
| Week 3-4 | **Principles of Thermodynamics for Engineers** | Lectures on the principles of thermodynamics, including heat transfer and energy conservation. Discussion on their applications in mechanical engineering. | Students will prepare a report on a thermodynamic system of their choice, analyzing it based on the principles discussed. | Report |
| Week 5-6 | **Understanding Forces and Energy in Mechanical Systems** | Interactive sessions on applying Newton's laws of motion to mechanical systems. Group activities to evaluate the motion and stability of systems under various forces. | Students will design and present a mechanical system, applying Newton's laws to analyze its forces and energy. | Presentation |
| Week 7-8 | **Behavior of Gases, Liquids, and Solids in Engineering** | Experimental labs to explore the behavior of materials under different conditions. Lectures on the implications of these behaviors in mechanical engineering applications. | Students will submit a lab report detailing their observations and implications of the behavior of gases, liquids, and solids. | Lab Report |
| Week 9-10 | **Waves and Optics Applications in Engineering** | Lectures on the principles of waves and optics and their engineering applications. Exploration of optical methods used in mechanical engineering through case studies. | Students will conduct a group project to explore an application of waves or optics in engineering, culminating in a class presentation. | Group Project and Presentation |
| Week 11-18 | **Review and Project Work** | Review sessions covering all topics. Students will work on a comprehensive project integrating concepts from mechanics, thermodynamics, waves, and optics to solve a real-world engineering problem. | Students will submit a final project report and present their project to the class. | Final Project Report and Presentation |

## References

*Dirik, M. (2023). The technical ingenuity of Al-Jazari and its relevance to contemporary engineering and design.*  
Link: https://www.journal.ar-raniry.ac.id/index.php/IJIHC/article/view/2482

*Bejan, A. (2022). Heat transfer: Evolution, design and performance.*  
Link: https://books.google.com/books?hl=en&lr=&id=scZ6EAAAQBAJ

*Shi, B., Peng, H., Wang, X., & Zhong, W. (2022). A symplectic direct method for motion-driven optimal control of mechanical systems.*  
Link: https://www.sciencedirect.com/science/article/pii/S1007570422001447

*Walker, J.D. (2021). Modern impact and penetration mechanics.*  
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*Zhong, S., Chen, L., Liang, W., Nsengiyumva, W., & others. (2024). Contactless torque sensors based on optical methods: A review.*  
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