

## Annexe A: New/Revised Course Content in OBTL+ Format

### Course Overview

Expected Implementation in Academic Year	AY2025-2026
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1
Course Author * Faculty proposing/revising the course	Chia Ee Min, Elbert
Course Author Email	elbertchia@ntu.edu.sg
Course Title	MECHANICS
Course Code	PH1104
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

### Course Requisites (if applicable)

Pre-requisites	Physics and Mathematics at A or H2 level, or equivalents
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

## Course Aims

This course aims to equip you with the basic concepts and problem solving skills in Mechanics. You will develop physical intuition and analytical skills which are important for studying physical systems and solve problems involving mechanical systems. These knowledge and skills lay the foundation for subsequent higher level courses.

## Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	perform basic vector operations (such as scalar and vector products, component addition and decomposition) and solve problems involving vector quantities
ILO 2	analyse and solve 1D and 2D kinematics problems (such as projectile motion)
ILO 3	analyse problems involving non-constant accelerations using basic calculus
ILO 4	analyse graphs relating to the motion of objects (such as displacement-time, velocity-time and acceleration-time graphs)
ILO 5	apply Newton's laws of motion to analyse the effects of forces acting on a system of objects in 1D and 2D
ILO 6	analyse the effects of air resistance and frictional forces on the motion of objects
ILO 7	apply the work-energy relation and conservation of energy to evaluate problems involving linear mechanics
ILO 8	derive the impulse-momentum relation, conservation of linear momentum and use them to analyse and solve collision, explosion, mass flow related problems
ILO 9	analyse and solve circular motion problems for point objects and rotational motion problems for rigid bodies
ILO 10	determine the centre of mass, moment of inertia of objects of simple geometry and solve problems related to static equilibrium and rotational motion
ILO 11	apply Newton's laws of motion to analyse the effects of torque acting on a system of objects in rotational motion
ILO 12	analyse and solve oblique collision problems using conservation of angular momentum
ILO 13	analyse and solve advanced problems relating translational motion and rotational motion in rolling
ILO 14	apply Newton's law of gravitation and rotational kinematics to analyse and solve problems

## Course Content

### **Linear Motion & Dynamics (LIN) :**

Vectors

Vector Decomposition

Vector Addition

Scalar Product (Dot Product)

Vector Product (Cross Product)

1D and 2D Kinematics

Newton's Laws of Motion

Work, Energy and Power

Conservation of Energy

Linear Kinetic Energy

Impulse and Momentum

Conservation of Linear Momentum

### **Rotational/Circular Motion & Dynamics (ROT) :**

Circular Motion

Rotational Kinematics

Moment of Inertia

Rotational Dynamics

Center of Mass

Rotational Kinetic Energy

Conservation of Angular Momentum

Rolling with Slipping

Rolling without Slipping

Gravitational Force

Gravitational Potential Energy

## Reading and References (if applicable)

1. University Physics with Modern Physics (Global Edition), 15th Edition, Hugh Young and Roger Freedman, Pearson (2020). ISBN 13: 978-1-292-31473-0
2. Physics for Scientists and Engineers, 10th Edition, R A Serway and J W Jewett Jr, Brooks Cole (2018). ISBN 13: 978-1337888585

## Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introduction to course; Vectors	1			Lectures, Tutorials, Clickers (ResponseWare), Mastering Physics online assignment
2	1D Kinematics	2			Lectures, Tutorials, Clickers (ResponseWare), Mastering Physics online assignment
3	2D Kinematics	2			Lectures, Tutorials, Clickers (ResponseWare), Mastering Physics online assignment
4	Forces and Newton's laws of Motion	3, 4			Lectures, Tutorials, Clickers (ResponseWare), Mastering Physics online assignment
5	Forces and Newton's laws of Motion	5, 6			Quiz 1
6	Work, Energy and Power	7			Lectures, Tutorials, Clickers (ResponseWare), Mastering Physics online assignment
7	Conservation of Energy	8			Quiz 2
8	Impulse-Momentum; Conservation of Momentum	8			Lectures, Tutorials, Clickers (ResponseWare), Mastering Physics online assignment

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
9	Impulse-Momentum; Conservation of Momentum	8			Quiz 3
10	Rotational Kinematics; Moment of Inertia	9			Lectures, Tutorials, Clickers (ResponseWare), Mastering Physics online assignment
11	Rotational Dynamics	10, 11			Lectures, Tutorials, Clickers (ResponseWare), Mastering Physics online assignment
12	Rotational Dynamics	12, 13			Quiz 4
13	Gravitation	14			Lectures, Tutorials, Clickers (ResponseWare), Mastering Physics online assignment

## Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Problem solving (Mastering Physics)	Develop competence and perseverance in solving physics problems with immediate learning feedback
Problem solving (tutorial and lecture)	Develop competence and perseverance in solving physics problems
Peer Instruction (during lecture)	Develop communication skills and competence in physics. You are encouraged to discuss their answers to the Clickers questions so that they can learn from one another.

# Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Summative Assessment (EXAM): Final exam(Final Examination)	All		55		Individual	Analytic	Extended Abstract
2	Continuous Assessment (CA): Assignment(CA1: Mastering Physics online assignments)	All		20		Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Test/Quiz(CA2: Quiz 1)	LIN 1-4		5		Individual	Analytic	Multistructural
4	Continuous Assessment (CA): Test/Quiz(CA3: Quiz 2)	LIN 2-7		5		Individual	Analytic	Multistructural
5	Continuous Assessment (CA): Test/Quiz(CA4: Quiz 3)	LIN 8, ROT 9-11		5		Individual	Analytic	Multistructural
6	Continuous Assessment (CA): Test/Quiz(CA5: Quiz 4)	ROT 9-13		5		Individual	Analytic	Multistructural
7	Continuous Assessment (CA): Class Participation(Wooclap participation)	All		5		Individual	Analytic	Multistructural

Description of Assessment Components (if applicable)

- (1) Final exam: MCQ + long questions  
 (2) CA1: Mastering Physics homework - online, weekly for 10 weeks.

- (3) Quiz 1: 25-30 MCQs on Vectors and Kinematics
- (4) Quiz 2: 3-4 short questions on Newton's Laws
- (5) Quiz 3: 25-30 MCQs on work, energy, power
- (6) Quiz 4: 3-4 short questions on rotational kinematics and dynamics

### Formative Feedback

You will receive formative feedback is given through discussion within tutorial lessons as well as interactive, computer- based hints and pointers in the Mastering Physics online assignment and resource system.

Formative feedback is also given via the student response application Clickers (ResponseWare) where you are required to answer on your mobile devices questions posted during lecture/tutorial. Feedback is always provided for your response to each question.

Finally, feedback is also given after each Quiz on the common mistakes and level of difficulty of the problems. Past Quiz questions are also made available for you.

## **NTU Graduate Attributes/Competency Mapping**

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

<b>Attributes/Competency</b>	<b>Level</b>
Creative Thinking	Intermediate
Curiosity	Intermediate
Decision Making	Intermediate
Problem Solving	Intermediate
Sense Making	Intermediate

# Course Policy

## Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

## Policy (General)

You are expected to complete all assigned pre-class readings and activities, attend all classes and tutorials punctually, and take all scheduled assignments and tests by due dates. You are expected to participate in all tutorial discussions and activities.

## Policy (Absenteeism)

### Absence Due to Medical or Other Reasons

If you are sick and unable to attend your class / Quizzes, you have to:

1. Send an email to the instructor regarding the absence and request for a replacement class and make-up mid-terms.
2. Submit the original Medical Certificate\* or official letter of excuse to administrator.
3. Attend the assigned replacement class (subject to availability) and make-up mid-terms.

\* The medical certificate mentioned above should be issued in Singapore by a medical practitioner registered with the Singapore Medical Association.

## Policy (Others, if applicable)

### Diversity and inclusion policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;

- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

Point-based marking (not rubric-based)