Academic Year	2023-24	**Semester**	1 and 2
Course Coordinator	Ho Shen Yong		
Course Code	PH1012		
Course Title	Physics A		
Pre-requisites	For students without A level Physics		
No of AUs	4 AU		
Contact Hours	2.5 hours Lecture 1.5 hours Tutorial		
Proposal Date	9 February 2023		

Course Aims

This course aims to equip you with the basic concepts and problem-solving skills in Mechanics, Thermal Physics and Electricity & Magnetism. You will develop physical intuition and analytical skills which are important for studying physical systems and solve problems involving the above three areas of Physics. These knowledge and skills lay the foundation for subsequent higher-level courses and are also critical in the engineering profession.

Intended Learning Outcomes (ILO)

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

Basics (BAS)

1. analyze physics formulas (in areas related to mechanics, thermal Physics, electricity and magnetism) and make simple estimates of physical quantities in daily life.
2. solve problems and explain daily phenomena involving mass, weight, density, pressure and buoyant force (upthrust);
3. perform basic vector operations and solve problems involving vector quantities;

Mechanics (MECH)

4. analyze and solve 1D and 2D kinematics problems (such as projectile motion, uniform and non-uniform circular motion).
5. apply Newton's laws of motion to analyze the effects of forces (including propulsive forces, frictional and viscous forces) acting on a system of objects in 1D and 2D;
6. apply the impulse-momentum relations, work-energy theorem and conservation laws associated with momentum and energy to solve problems.
7. apply Newton's law of gravitation to analyze and solve problems;
8. determine the center of mass, moment of inertia of objects of simple geometry and solve problems related to static equilibrium and rotational motion.

Electricity and Magnetism (EM)

9. explain phenomena involving charges and solve problems involving a system of charges or charge objects of simple geometry using Coulomb's law or Gauss's law.
10. perform analysis of static and time-dependent circuits using basic concepts and rules (such as Kirchhoff's Laws, resistance and capacitance);

11. explain phenomena involving magnetic fields and solve problems involving magnetic forces and magnetic fields due to current using Ampere's law;
12. apply Faraday's Law and Lenz's Law to analyze and solve problems involving electromagnetic induction;

Thermal Physics (TP)

13. analyze and solve problems involving thermal properties of matter (such as thermal expansion, heat transfer involving solid and fluids, kinetic theory of gases).
14. apply the concepts in thermal physics and the first law of thermodynamics to analyse a given heat engine.

Synthesis of Knowledge and Skills in above areas

15. analyze and solve real-life problems that require an integrated knowledge of basic physics, mechanics, electricity and magnetism, and thermal physics.

Course Content

Basics (BAS)

Units
Mass, Weight and Density
Atoms, Microscopic Structures and States of Matter
Pressure and Buoyant force
Vectors

Mechanics (MECH)

1D and 2D Kinematics
Newton's Laws of Motion
Circular Motion
Forces, Impulse and Momentum
Work, Energy and Power
Centre of Mass
Moment of Inertia
Rotational Kinematics and Dynamics
Gravitational Field

Electricity and Magnetism (EM)

Electric Forces and Coulomb's Law
Electric Field and Potential
Gauss's Law
Current Electricity
Kirchhoff's Laws and D.C. Circuits
Resistors and Resistance
Capacitance and Capacitors
RC Circuits
Electrical Power
Magnetic Fields and Forces

Ampere's Law
Electromagnetic Induction
Faraday's Law and Lenz's Law

Thermal Physics (TP)

Zeroth Law of Thermodynamics
Temperature and Thermometer
Thermal Expansion
Heat Capacities and Latent Heat
Ideal Gases
Kinetic Theory of Gases
First Law of Thermodynamics
Heat Engines

Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Weighting	Team / Individual	Assessment Rubrics
1. Final Examination	All	55%	Individual	Point-based marking (not rubric-based)
2. CA1: Weekly In-class Participation	All	15% (Lecture and Tutorial)	Individual	Point-based marking (not rubric-based) – Using Learning Catalytics
3. CA2: Weekly Online Assignment	All	10%	Individual	Point-based marking (not rubric-based) Using Mastering Physics
4. CA3: Mid-term Test 1	BAS 1-3 MECH 4-6 TP 13	10%	Individual	Point-based marking (not rubric-based)
5. CA4: Mid-term Test 2	MECH 4-7 EM 9-10	10%	Individual	Point-based marking (not rubric-based)
Total		100%		

Formative feedback

You will receive formative feedback 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 Learning Catalytics 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 midterm on the common mistakes and level of difficulty of the problems. Past exam questions and examiner's report are also made available for you.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Problem solving (tutorial and lecture)	Develop competence and perseverance in solving physics problems
Hands-on group activities (during tutorial)	Develop physical intuition and competence in solving real-life problems. Relate everyday phenomena to physics.
Peer Instruction (during lecture)	Develop communication skills and competence in physics. You are encouraged to discuss about their answers posted on Learning Catalytics so that they can learn from one another.

Reading and References

1. Physics for Scientists & Engineers with Modern Physics, 4th Edition, Douglas C. Giancoli, Pearson (2008), ISBN No. 978-0131495081. [Text]
2. R Knight: Physics for Scientists and Engineers: A Strategic Approach with Modern Physics and Mastering Physics, 3rd Edition, ISBN No. 978-0321740908. (Pearson)
3. R A Serway, J W Jewett Jr: Physics for Scientists and Engineers, 8th Edition, ISBN No. 978-1439048443. (Brooks Cole)
4. W Bauer and G D Westfall: University Physics with modern Physics, ISBN No. 978-0073513881. (McGraw Hill)

Course Policies and Student Responsibilities

Absence Due to Medical or Other Reasons

If you are sick and unable to attend your class / Mid-terms, 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.

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. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Ho Shen Yong	SPMS PAP 03-07	65927816	hosy@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Basic physical quantities in Mechanics, Thermal Physics and Electricity & Magnetism	BAS 1-2, TP13	Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos
2	1D Kinematics; Vectors	BAS 3, MECH 4	
3	2D Kinematics	MECH 4	
4	Forces and Newton's laws of Motion	MECH 5	
5	Circular Motion; Torque and Equilibrium	MECH 4, 5, 8	Mid-term Test 1
6	Impulse-Momentum; Conservation of Momentum	MECH 6	Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos
7	Work, Energy and Power; Gravitation	MECH 6, 7	
8	Electric Fields	EM 9	
9	Electric Potential and Circuits; Capacitance	EM 9-10	
10	Magnetic Fields and Electromagnetic Induction	EM 11-12	Mid-term Test 2
11	Rotational Dynamics	MECH 8	Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos
12	Kinetic theory of gases; first law of thermodynamics and heat engines	TP 13-14	
13	Revision	ALL	