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

Course Overview

Expected Implementation in Academic Year	AY2023-2024
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1 Semester 2
Course Author * Faculty proposing/revising the course	Ho Shen Yong
Course Author Email	hosy@ntu.edu.sg
Course Title	Physics A
Course Code	PH1012
Academic Units	4
Contact Hours	52
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	For students without A level Physics
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, 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.

Course's Intended Learning Outcomes (ILOs)

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

ILO 1	analyze physics formulas (in areas related to mechanics, thermal Physics, electricity and magnetism) and make simple estimates of physical quantities in daily life
ILO 2	solve problems and explain daily phenomena involving mass, weight, density, pressure and buoyant force (upthrust)
ILO 3	perform basic vector operations and solve problems involving vector quantities
ILO 4	analyze and solve 1D and 2D kinematics problems (such as projectile motion, uniform and non-uniform circular motion)
ILO 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
ILO 6	apply the impulse-momentum relations, work-energy theorem and conservation laws associated with momentum and energy to solve problems
ILO 7	apply Newton's law of gravitation to analyze and solve problems
ILO 8	determine the center of mass, moment of inertia of objects of simple geometry and solve problems related to static equilibrium and rotational motion
ILO 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
ILO 10	perform analysis of static and time-dependent circuits using basic concepts and rules (such as Kirchhoff's Laws, resistance and capacitance)
ILO 11	explain phenomena involving magnetic fields and solve problems involving magnetic forces and magnetic fields due to current using Ampere's law
ILO 12	apply Faraday's Law and Lenz's Law to analyze and solve problems involving electromagnetic induction
ILO 13	analyze and solve problems involving thermal properties of matter (such as thermal expansion, heat transfer involving solid and fluids, kinetic theory of gases)
ILO 14	apply the concepts in thermal physics and the first law of thermodynamics to analyse a given heat engine
ILO 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

Reading and References (if applicable)

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)

Planned Schedule

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
1	Basic physical quantities in Mechanics, Thermal Physics and Electricity & Magnetism	1, 2, 13		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	
2	1D Kinematics; Vectors	3, 4		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	
3	2D Kinematics	4		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	
4	Forces and Newton's laws of Motion	5		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	
5	Circular Motion; Torque and Equilibrium	4, 5, 8		Mid-term Test 1	
6	Impulse-Momentum; Conservation of Momentum	6		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
7	Work, Energy and Power; Gravitation	6, 7		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	
8	Electric Fields	9		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	
9	Electric Potential and Circuits; Capacitance	9, 10		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	
10	Magnetic Fields and Electromagnetic Induction	11, 12		Mid-term Test 2	
11	Rotational Dynamics	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	13, 14		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	
13	Revision	All		Pre-lecture videos, In-class Learning Catalytics Mastering Physics on-line assignment, Post-tutorial videos	

Learning and Teaching Approach

Approach	How does this approach support you 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.

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	Holistic	Relational
2	Continuous Assessment (CA): Class Participation(CA1: Weekly In-class Participation)	All		15		Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Assignment(CA2: Weekly Online Assignment)	All		10		Individual	Analytic	Multistructural
4	Continuous Assessment (CA): Test/Quiz(CA3: Mid-term Test 1)	BAS 1-3 MECH 4-6 TP 13		10		Individual	Analytic	Relational
5	Continuous Assessment (CA): Test/Quiz(CA4: Mid-term Test 2)	MECH 4-7 EM 9-10		10		Individual	Analytic	Relational

Description of Assessment Components (if applicable)

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.

NTU Graduate Attributes/Competency Mapping

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

Attributes/Competency	Level
Care for Society	Basic
Curiosity	Intermediate
Learning Agility	Intermediate
Critical Thinking	Intermediate
Systems Thinking	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)

Policy (Absenteeism)

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.

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.