NANYANG TECHNOLOGICAL UNIVERSITY

Teaching, Learning and Pedagogy Division

Reg. No. 200604393R

Academic Year	2021/22	**Semester**	1
Course Coordinator	KOH TECK SENG		
Course Code	CY1308		
Course Title	PHYSICS		
Pre-requisites	NIL		
No of AUs	3		
Contact Hours	1.5 hr – lecture (online); 1.5 hr – tutorial		
Proposal Date	Jan 2021		

Course Aims

This first year core course in the CN Yang programme aims to develop students' understanding of fundamental physical concepts in the topics of mechanics, electricity, magnetism and thermodynamics, which are applicable to science, mathematics and engineering specialisations. In addition, the course contains special topics which highlight the connection between Physics and other disciplines.

Intended Learning Outcomes (ILO)

By the end of this course, you (as a student) would be able to:

Broadly,

- Explain and apply fundamental physics principles to solve problems involving mechanics, electricity and magnetism, and thermodynamics.
- Illustrate appropriate physical phenomena related to the topics covered and communicate scientifically accurate explanations of such phenomena.

Specifically, by topic:

(1) Mechanics

a. apply conservation principles to explain physical phenomena.
b. apply concepts, definitions and laws involving linear and rotational motion to explain and solve problems in equilibrium and non-equilibrium situations.
c. Understand and apply fluid mechanics equations to simple problems, and appreciate the connections with motion of biological entities in fluid media.

(2) Electricity and Magnetism

a. apply the concept of a field of force and its related field quantities to solve problems involving electric and gravitational fields.
b. apply fundamental laws involving electricity and magnetism (e.g. Gauss' Law, Coulomb's Law, Ampere's Law, Biot-Savart Law, Faraday's Law, Lenz's Law, etc) to explain or analyse electrical and magnetic phenomena.
c. apply electromagnetism concepts and laws to analyse and solve problems involving chemical bonding and intermolecular interactions.

d. apply circuit concepts and rules (e.g. Kirchhoff's Laws, resistance, capacitance and inductance) to solve static and time-dependent circuits.
e. Explain microscopic phenomena in terms of charge to macroscopic circuit quantities (e.g. current, resistance capacitance, etc.)

(3) Thermodynamics
a. Appreciate and use fundamental laws and concepts (e.g. the zeroth law of thermodynamics, temperature, heat, thermal equilibrium, etc.) to explain or analyse thermodynamics phenomena qualitatively.
b. Identify and explain the connections between thermodynamics and climate change.

(4) Modelling
a. Design simple experiments to perform observations of, analyse and explain actual physical situations.
b. Communicate relevant scientific information with clarity, critical thought and creativity.

(5) Special topics: Interdisciplinary connections
a. Fluid mechanics and Biology – Life at low Reynold's number
b. Intermolecular interactions in chemistry
c. Thermodynamics of climate change

Course Content

Vectors and Kinematics
Newton's Laws of Motion
Forces, Impulse and Momentum
Work, Energy and Power
Rotational Kinematics and Dynamics
Centre of Mass
Moment of Inertia
Gravitational Field
Electric Field
Electric Circuits
Magnetic Field
Electromagnetism
Thermodynamics

Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment rubrics
1. Final Examination	All	Competence	30%	Individual	Point-based marking (not rubric-based)
2. Homework	All	Competence	20%	Individual	Point-based, marking (not rubric-based)
4. Mid Term 1	Subset of topics	Competence	15%	Individual	Point-based marking (not rubric-based)

5. Mid Term 2	Subset of topics	Competence	15%	Individual	Point-based marking (not rubric-based)
6. Project (Group)	All	Competence Creativity Communication	20%	Team	Rubric based (See Appendix)
Total			100%		

* EAB SLO stands for the Engineering Accreditation Board Student Learning Outcomes. For the full list of student learning outcomes, please take a look at page 14 of this document.

Note:

i. *Programme LOs are the learning outcomes for the undergraduate degree programme. The course learning outcomes should be mapped to the programme learning outcomes.*

ii. *If the programme which your course belong to already has a set of programme learning outcomes, such as the EAB student learning outcomes, please indicate them in column 3. Otherwise, please indicate the graduate attributes the course learning outcome is related to. Graduate attributes refer to the 5 Cs of NTU. You can find them here.*

iii. *The guideline is to have not more than 60% weight for the final exam. Please highlight and provide justifications for deviation.*

iv. *Attendance in class shall not be a component of CA.*

v. *Class participation as a CA component should be accorded a reasonable weight and be justified.*

For more resources on programme LO, visit TLPD's programme design page
For more resources on assessment tasks, visit TLPD's course design page, section 4.3

Formative feedback

Formative feedback is given through discussion within tutorial lessons as well as interactive, computer based hints and pointers in the MasteringPhysics online homework and resource system.

Feedback is also given after each midterm on the common mistakes and level of difficulty of the problems.

Learning and Teaching approach

Description of the learning approach for example lecture, tutorial, Team-Based Learning, project, etc.
For some ideas on learning approach, please visit the TLPD course design page (section 4.4)

Approach	How does this approach support students in achieving the learning outcomes?
Tiered Problem solving (from conceptual to mathematical)	Develop competence in understanding physical concepts and solving physics problems
Hands-on group activities (during tutorial)	Develop physical intuition and competence in solving real-life problems. Relate everyday phenomena to physics.
Team-Based Learning during tutorial and for project	Develop communication skills and competence in physics.
Project-Based Learning	Develop communication skills, and competence in experimentation, analytical and numerical modelling, critical and creative thinking.

Reading and References

1. Physics for Scientists & Engineers with Modern Physics, 4th Edition, Douglas C. Giancoli, Pearson (2008).
2. University Physics with Modern Physics, 14th Edition, Hugh Young and Roger Freedman, Pearson (2015).

Course Policies and Student Responsibilities

Suggested fields for this portions include ***general policies with regards to students' assignment, punctuality absenteeism****, etc.*

Absence Due to Medical or Other Reasons

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

1. Send an email to the instructor regarding the absence and request for a replacement class.
2. Submit the original Medical Certificate***** to administrator.
3. Attend the assigned replacement class (*subject to availability*).

***** 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.

Note: This is a standard recommended text for academic integrity in the course. If you wish to amend, please make sure that it is in accordance with the official policy by visiting the link provided above.

Course Instructors

Instructor	Office Location	Phone	Email
KOH Teck Seng	SPMS-PAP-03-08	6514 1066	kohteckseng@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Vectors and Kinematics	1a, 1b	All lectures are online and readings will be assigned after each video lecture is viewed.
2	Newton's Laws of Motion	1a, 1b	
3	Forces, Impulse and Momentum	1a, 1b	
4	Work, Energy and Power	1a, 1b	
5	Rotational Kinematics and Dynamics	1a, 1b	
6	Centre of Mass Moment of Inertia	1a, 1b	
7	Fluid Mechanics and special topic 5.a.	1c, 5a	
8	Electric Field and special topic 5.b.	2a, 2b, 2c, 5b	
9	DC Circuits	2d, 2e	
10	Magnetic Field	2a, 2b, 2c	
11	Electromagnetic Induction	2a, 2b, 2c	
12	AC circuits	2d	
13	Thermodynamics and special topic 5.c.	3a, 3b, 5c	Group Presentation of Projects

Appendix 1: Assessment Criteria for Group Project

Presentation Rubrics (10%)

Criteria	Exceeds Standard (10 – 9)	Meets Standard (8 – 6)	Almost Meets Standard (5.5 – 3.5)	Does not meet standard (3 – 0)
Engagement	Arouses interest and engages attention of audience throughout the presentation.	Arouses interest and engages attention of audience through most of the presentation.	Maintains attention of audience through part of the presentation.	Loses attention of audience through most of the presentation.
Scientific communication	Communicates difficult or complex ideas in an effective and understandable manner	Communicates ideas in an effective and understandable manner	Communicates ideas somewhat effectively, which are mostly understandable.	Does not communicate ideas effectively.

The main presentation should include:

• a ***presentation*** of the appropriate ***concepts, theories and principles*** of the problem
• an ***explanation*** of the ***observed phenomena***
• an ***application*** of ***appropriate mathematics***
• reasonable **experimental technique** to ***gather*** and ***record data*** (or ***demonstrate*** the ***phenomena*** if appropriate)
• linking of ***theoretical*** and ***experimental findings*** to draw ***suitable conclusions***
• an attempt to communicate ***difficult*** or ***complex*** ideas in an ***effective*** and ***understandable*** manner

Note on individual score for group project:

To do well on the team assessment, it is necessary for you to demonstrate positive interdependence and teamwork. In principle, you will receive the same marks as your team. However, your individual score may vary based on feedback about your contributions.

Report Rubrics (10%)

Adapted from https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf

Criteria	Exceeds Standard (10 – 9)	Meets Standard (8 – 6)	Almost Meets Standard (5.5 – 3.5)	Does not meet standard (3 – 0)
Problem or Research Statement	Clearly and accurately communicated, and gives background or context and motivation.	Clearly and accurately communicated.	Somewhat unclear or unable to accurately portray the problem.	Unclear and inaccurate or illogical statement.
Correct and appropriate physics	Correct and appropriate use of physics, with assumptions, approximations, experimental techniques, and derivations that are accurate and detailed.	Correct and appropriate use of physics, with some clarity on assumptions, approximations, experimental techniques, and derivations.	Mostly correct and appropriate use of physics.	Incorrect or inappropriate use of physics in most areas.
Scientific Approach	Appropriate and addresses the problem from multiple perspectives.	Appropriate and address the problem from a single perspective.	Somehwat appropriate, and addresses an incomplete subset of the problem.	Inappropriate or illogical, and does not address the problem.
Significance of Results and Conclusions	Presents a logical and complete explanation for findings and addresses most of the questions. Ends with logical, effective and relevant conclusion	Presents a logical explanation for findings and addresses some of the questions. Ends with coherent conclusion based on evidence.	Presents an incomplete explanation for findings and addresses few questions. Ends with a conclusion based on evidence.	Presents an incomplete or wrong explanation for findings and does not address any of the questions. Ends without a conclusion.
References and Citations	Proper, accurate and clear citations and attribution of others' work.	Proper, accurate and clear citations and attribution of others' work.	Proper and clear citations and attribution of others' work, with minor errors.	Proper and clear citations and attribution of others' work, with major errors.
Development of Ideas	Introduces the topic clearly and creatively. Maintains clear focus on the topic. Development of and connection between ideas are clear and correct.	Introduces the topic clearly. Maintains focus on the topic. Development of and/or connection between ideas are clear and correct.	Introduces the topic. Somewhat maintains focus on the topic. Development of some ideas are clear.	Does not clearly introduce the topic. Does not establish or maintain focus on the topic.

Besides the above, any other creative means of presenting any aspect of the report, e.g. videos that illustrate the experiment / phenomenon, should be included as well to supplement the report. Note that such supplementary material is commonly reported in Physics journals.