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 2
Course Author * Faculty proposing/revising the course	Lim Chu Keong Gerard Joseph
Course Author Email	gerardjosephlim@ntu.edu.sg
Course Title	Electricity and Magnetism
Course Code	PH1106
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	
Co-requisites	
Pre-requisite to	
Mutually exclusive to	CY1302, CY1306, EE1002, PH1011, PH1012, PH1102, PH116S, PH1802
Replacement course to	
Remarks (if any)	

Course Aims

The course aims to guide you towards a basic understanding of the key ideas within fields and oscillations through the various concepts in electrostatics, magnetism, simple harmonic motion and electric circuits. Through problem solving, you would develop the physical intuition and analytical skills useful in these Physics topics. You would also learn to apply these theoretical concepts in real world situations.

Course's Intended Learning Outcomes (ILOs)

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

ILO 1	describe how objects become electrically charged and the behaviour of charges in the objects
ILO 2	apply appropriate theoretical concepts (such as Coulomb's law and Gauss's law) to determine the electric force and electric field of various charge distributions
ILO 3	evaluate the electric potential and electric potential energy of a collection of charges
ILO 4	relate the electric force, electric field, electric potential and electric potential energy
ILO 5	describe the basic properties of magnets, and how magnet interact with each other
ILO 6	determine the magnetic forces on current-carrying conductors and moving charged particles and their practical applications
ILO 7	apply appropriate theoretical concepts (such as Biot-Savart's law and Ampere's law) to determine the magnetic field by various current distribution
ILO 8	determine the induced emf using Faraday's law and Lenz's law
ILO 9	determine the mutual inductance and self-inductance due to changing current in coils and the energy stored in a magnetic field
ILO 10	discuss how an electric current is formed and how to calculate the resistance of a conductor from its dimensions, its resistivity or conductivity
ILO 11	determine various electrical quantities (such as current, potential difference and resistance) using Ohm's law
ILO 12	determine electrical quantities (such as electrical energy and power) in circuits
ILO 13	analyse simple circuits with multiple resistors and capacitors (such as determining electrical quantities in simple circuits with multiple loops and components using Kirchhoff's law)
ILO 14	describe sinusoidally varying quantities (such as potential difference and current) using phasors and analyse L-R-C (Inductor-Resistor-Capacitor) series circuit with sinusoidal emfs of different frequencies
ILO 15	discuss the working principle of transformers

Course Content

Electric Fields (EF)
Coulomb's Law
Electric Field and Potential
Gauss' Law in Electrostatics
Microscopic Model of Electrical Conduction
Electrical Current
Conductivity and Resistivity of a Material
Ohm's Law and Resistance
Capacitors and Capacitance

Magnetic Fields (MF)
Biot-Savart's Law
Ampere's Law
Solenoids
Lorentz Force
Hall effect
Gauss Law in Magnetism
Faraday's Law and Lenz's law
Inductors and Inductance

Electrical Circuits (EC)
Voltage, Current and Resistance
Electrical Power
Kirchhoff's Laws and Direct Current (D.C.) Circuits
Resistor-Capacitor (RC) Circuits
Oscillations in Electrical Circuits
Inductor-Capacitor (LC) Circuits and Relative Phases
Resistor-Capacitor- Inductor (RLC) Circuits and Electrical Resonance

Reading and References (if applicable)

1. University Physics with Modern Physics, 15th Edition, Hugh Young and Roger Freedman, Pearson (2021). ISBN-13: 978-9353949297

NOTE: The above listing comprises the foundational readings for the course and more up-to-date relevant readings will be provided when they are available.

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Electric charges and electric field	1, 2	Textbook and lecture notes, videos	In-person	Lecture WooClap
2	Gauss's Law	2	Textbook and lecture notes, videos	In-person	Lecture WooClap
3	Electric Potential and Electric Energy	3, 4	Textbook and lecture notes, videos	In-person	Lecture WooClap
4	Capacitors and Capacitance	13	Textbook and lecture notes, videos	In-person	Lecture WooClap
5	Current, resistance, and electromotive force Midterm 1 - Topics in Week 1-5	10 - 12 Review and practice of problem-solving skills.	Textbook and lecture notes, videos	In-person	Lecture WooClap Midterm Test 1
6	DC and RC Circuits	12, 13	Textbook and lecture notes, videos	In-person	Lecture WooClap
7	Magnetic field and magnetic forces	5, 6	Textbook and lecture notes, videos	In-person	Lecture WooClap
8	Magnetic force on electric currents	6	Textbook and lecture notes, videos	In-person	Lecture WooClap

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
9	Sources of magnetic field	7 Review and practice of problem-solving skills.	Textbook and lecture notes, videos	In-person	Lecture WooClap Midterm Test 2
10	Electromagnetic induction Midterm 2 - Topics in Week 1-10 Increased weightage on Week 7 to 10 content.	8 Review and practice of problem-solving skills.	Textbook and lecture notes, videos	In-person	Lecture WooClap MidTerm Test 2
11	Mutual inductance and Self inductance	9	Textbook and lecture notes, videos	In-person	Lecture WooClap
12	Circuits with Inductor	9, 13	Textbook and lecture notes, videos	In-person	Lecture WooClap
13	A.C. Circuits	14, 15	Textbook and lecture notes, videos	In-person	LEcture WooClap

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	Warm-up questions will be raised first, followed by lectures that further explains the physics based on the questions. Then wrap-up questions will also be provided. Wooclap will be exercised at the end of lectures.
Tutorial	You will be reviewing main concepts learned in lectures with TAs. This helps you to digest and understand better.
Homework	The homework comprises standard textbook practice questions that are covered during tutorial.

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		45		Individual	Analytic	Relational
2	Continuous Assessment (CA): Assignment(CA1: Homework)	All		10		Individual	Analytic	Relational
3	Continuous Assessment (CA): Test/Quiz(CA2: Mid-term Test 1)	EF 1-4, EC 10-13		20		Individual	Analytic	Relational
4	Continuous Assessment (CA): Test/Quiz(CA3: Mid-term Test 2)	EF 1-4, EC 10-13, MF 5-8		20		Individual	Analytic	Relational
5	Continuous Assessment (CA): Class Participation(CA4: In-Class Participation, WooClap)	All		5		Individual	Analytic	Relational

Description of Assessment Components (if applicable)

CA1 Homework: Students will have to attempt, complete, and submit a set of questions that will be discussed in tutorial class. Additional optional questions are available for discussion.
CA2: Students will be tested on the materials covered from weeks 1 to 5.
CA3: Students will be tested on the materials covered from weeks 1 to 10, with a focus on materials covered in weeks 7 to 10.
CA4: Wooclap is exercised at the end of lectures as a means of reviewing the content covered during the lecture.

Formative Feedback

Formative feedback is given through discussion within both lecture and tutorial lessons, as well as during consultation hours. Further feedback is given after the lectures, as the lecturer will remain available for questioning for around 1h after class.

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 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
Curiosity	Basic
Problem Solving	Basic

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)

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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.