TISHK INTERNATIONAL UNIVERSITY
FACULTY OF EDUCATION
Department of PHYSICS EDUCATION,
2022-2023 Spring
Course Information for PHYS 226 ELECTRICITY AND MAGNETISM II

Course Name:	ELECTRICITY AND MAGNETISM II

Code	Regular Semester	Theoretical	Practical	Credits	ECTS
PHYS 226	4	3	2	4	5

Name of Lecturer(s):	Azeez Abdullah Azeez
Teaching Assistant:	Ms. Payam Najmadden
Course Language:	English
Course Type:	Main
Office Hours	Tuesday-Thursday by appointment
Contact Email:	azeez.abdullah@tiu.edu.iq Tel:07504542010
Teacher's academic profile:	B.Sc in Physics Salahaddin University-Erbil 1998 M.Sc in Superconductivity Salahaddin University-Erbil 2004 Ph.D in Materials Science Leicester University, Leicester,UK 2014
Course Objectives:	Define electric current (I). Understand in which direction charge moves and current flows. Calculate electric current, current density, drift velocity. Know what happens when a current comes to a junction in a circuit. Define resistance (R) and know how it can be altered. Use Ohm's law to design circuits. Calculate resistance from resistivity (conductivity). Calculate power in electric circuits (both electrical energy transfer and energy lost through resistance). Describe several ways that power losses can be minimized in electricity transmission. Understand how superconductivity is related to resistivity & explain possible applications including like power transmission, magnetic levitation, MRI, etc. Define electromotive force (EMF). Understand how batteries work. Calculate R equivalent for resistors in series and in parallel. Analyze multi-loop circuits using the junction rule and the loop rule (Kirchhoffs rules). Understand how to use an ammeter, voltmeter, ohmmeter, and potentiometer in a circuit. Analyze circuits that include both a resistor and capacitor (RC circuits). Calculate current and capacitor charge for a charging/discharging RC circuit. Understand the role of the capacitive time constant (τ) in a charging/discharging RC circuit. Draw the graphs of current and capacitor charge as a function of time for a charging/discharging RC circuit. Explain phenomena such as an electric eel does not cook itself while killing prey, electric signals in the body, the correct way to wire a house, etc. Define magnetic field (B). Know what situations can create a magnetic field. Draw magnetic field lines around: bar magnet, horseshoe magnet, Earth, etc. Calculate the force felt by a charged particle moving in a magnetic field Know in which situations the charged particle's motion is circular, helical or in a straight line. Calculate the force on a current-carrying wire in a magnetic field. Explain applications of this chapter's theory including: discovery of the electron's charge, mass spectrometers, EKG machines, electric motors, cathode ray tubes, etc. Draw magnetic field lines around a wire and through a solenoid. Use the Biot-Savart law to calculate the magnetic field at a point due to: infinite straight wire, circle of wire, finite straight wire, etc. In cases with special symmetry, use Ampère's Law instead to calculate the magnetic field: inside and outside a cylindrical wire, infinite straight wire, solenoid, etc. Calculate the magnetic dipole moment of a loop or of a solenoid. Understand how a wire loop or solenoid feels a torque when placed in a magnetic field. Understand applications: how speakers work, electric motor, etc. Know that changing the magnetic flux through a wire or solenoid induces a current & EMF in the wire. Use Faraday's law of induction to calculate the induced EMF. Use Lenz's law to predict which way the current/EMF will be. Understand eddy currents and losses due to heat. Know what an inductor is. Define inductance (L) and know what it depends on. Explain how the following work: traffic light sensor, vibrating sample magnetometer, etc.
Course Description (Course overview):	This course is designed to help students get familiar with electric current, current density, " pumping V charge, work, energy, and emf, calculating the current in a single-loop circuit, what produces a magnetic field?, discovery of the electron, magnetic force on a current-carrying wire, the magnetic dipole moment, calculating the magnetic field due to a current, Biot-Savart Law, ampere's law, faradays law of induction, lenz's law.

COURSE CONTENT

Week	Hour	Date	Topic
1	3	29/1-2/2/2023	Introduction
2	3	5-9/2/2023	Electric Charge
3	3	12-16/2/2023	Electric Fields
4	3	19-23/2/2023	Gauss's Law
5	3	26/2-2/3/2023	Electric Potential
6	3	5-9/3/2023	Capacitance
7	3	12-16/3/2023	Current and Resistance
8	3	19-23/3/2023	Circuits
9	3	26-30/3/2023	Magnetic Fields
10	3	2-6/4/2023	Midterm Exam
11	3	9-13/4/2023	Magnetic Fields due to Currents
12	3	16-20/4/2023	Induction and Inductance

13	3	23-27/4/2023	Magnetism of Matter
14	3	30/4-4/5/2023	Electromagnetic Oscillations and Alternating Current
15	3	7-11/5/2023	Electromagnetic Waves
16	3	14-18/5/2023	Blat-Savart Law
17	3	21-25/5/2023	Ampere's Law and Its Applications
18	3	28/5-1/6/2023	Final Exam
19	3	4-8/6/2023	Final Exam

COURSE/STUDENT LEARNING OUTCOMES

1	Learning about current, resistance, and emf. Analysis of simple electric circuits using Kirchhoff's laws.
2	Calculating the Current in a Single-Loop Circuit, Multiloop Circuits.
3	Learning about origins of the magnetic field and its calculations.
4	Learning about and solving problems related to Faraday's and Lenz laws and their applications.
5	Operate basic Laboratory equipment, collect, analyze, and plot data, write results and draw conclusions in a submitted report.

COURSE'S CONTRIBUTION TO PROGRAM OUTCOMES

(Blank : no contribution, I: Introduction, P: Profecient, A: Advanced)

	Program Learning Outcomes	**Cont.**
1	Discuss concepts and principles of physics.	I
2	Conduct proper experiments safely and interpret the data in physics teaching physics.	P
3	Use the results of recent education and subject-specific developmental research when designing, implementing and justifying their own practice as a teacher.	P
4	Apply analytical and theoretical skills to model and solve physics problems.	P
5	Identify students' misconceptions and deal with them in classroom.	P
6	Prepare physics lessons with appropriate learning materials and teaching methods.	P
7	Effectively assess, plan, teach, organize, and manage physics classrooms.	P
8	Use appropriate methods and techniques to improve students' critical thinking, creative thinking and problem-solving skills in physics.	P
9	Use required modern methods and techniques for student-centered teaching by considering individual and cultural differences of students.	P
10	Effectively use a variety of teaching technologies and techniques and classroom strategies to foster student learning.	P
11	Communicate effectively and work collaboratively within the context of a global society.	
12	Exhibit character and decision-making skills embodying professionalism and ethical behavior.	

Prerequisites (Course Reading List and References):	PHYS 122 Introduction to Physics II
Student's obligation (Special Requirements):	Attending 80% of the course is mandatory. Participation in class activities is encouraged. Students are responsible for materials given in class. Students are responsible for assignments. Students must bring their own calculators.

Weekly Laboratory/Practice Plan:

Week	**Hour**	**Date**	**Topics**
1	2	29/1-2/2/2023	Introduction
2	2	5-9/2/2023	Charging and discharging a capacitor when switching AC on and off (with CRO)-1
3	2	12-16/2/2023	Charging and discharging a capacitor when switching AC on and off (with CRO)-2
4	2	19-23/2/2023	Measuring the current in a coil when switching AC on and off (L)-1
5	2	26/2-2/3/2023	Measuring the current in a coil when switching AC on and off (L)-2
6	2	5-9/3/2023	Magnetic force due to a current-carrying wire using current balance
7	2	12-16/3/2023	Determining the inductive reactance of a coil in an AC circuit (XL)
8	2	19-23/3/2023	Determining the capacitive reactance of a capacitor in an AC circuit (XC)
9	2	26-30/3/2023	Determining capacitive reactance with a Wien measuring bridge
10	2	2-6/4/2023	Determining inductive reactance with a Maxwell measuring bridge
11	2	9-13/4/2023	Determining Reactance of a Circuit
12	2	16-20/4/2023	Determining RC Reactance
13	2	23-27/4/2023	Determining RL Reactance
14	2	30/4-4/5/2023	Determining Resonance of Parallel connection LC Circuit

	15	2	7-11/5/2023	Determining Resonance of Series connection LC circuit
	16	2	14-18/5/2023	Discussion of Resonance
	17	2	21-25/5/2023	Discussion of Resonance
	18	2	28/5-1/6/2023	Discussion of Resonance
	19	2	4-8/6/2023	Discussion of Resonance

Course Book/Textbook:	"Fundamentals of Physics", by Halliday, Resnick and Walker, Ninth Edition, John Wiley & Sons, Inc (2011).
Other Course Materials/References:	"College Pysics" Serway9th edition "Physics"9th-Edition John D. Cutnell & Kenneth W. Johnson
Teaching Methods (Forms of Teaching):	Lectures, Practical sessions, Exercises, Presentation, Project, Assignments, , ,

COURSE EVALUATION CRITERIA

Method	Quantity	Percentage (%)
Participation	1	5
Quiz	2	2.5
Homework	5	1
Midterm Exam	1	20
Laboratory	1	10
Lab/Practical Exam(s)	1	15
Final Exam	1	40
Total		**100**

Examinations: Essay Questions, Multiple Choices, Short Answers, Matching, , ,

Extra Notes:

ECTS (ALLOCATED BASED ON STUDENT) WORKLOAD

Activities	Quantity	Workload Hours for 1 quantity*	Total Workload
Theoretical Hours	19	3	57
Practical Hours	19	2	19
Final Exam	1	5	5
Participation	1	3	3
Quiz	2	4	8
Homework	5	4	20
Midterm Exam	1		0
Laboratory	1		0
Lab/Practical Exam(s)	1		0
Total Workload			**112**
ECTS Credit (Total workload/25)			**4**

Peer review

Signature:	Signature:	Signature:
Name:	Name:	Name:
Lecturer	Head of Department	Dean