School of Engineering and Physical Sciences
Department of Mathematics and Physics

Course Name	**PHYSICS II**
Course Code	PHY 108
Course Credit Hours	3
Prerequisite	Physics I (PHY 107) and Calculus II (MAT 130)
Course Objective	This course is designed to introduce a variety of phenomena in electromagnetism such as electric charges and their interaction with electric and magnetic fields as well as current, inductors, capacitors, and electrical properties of circuits.
Course Description	Students analyze Coulomb's law, Gauss' law, Kirchhoff's laws, Ampere's law, Ohm's law, Faraday's Law, Lenz's law as well as their application to a variety of phenomena including static charges, currents, and magnetic fields, circuits, power, induction, coils, and solenoids. Students participate in interactive lectures and are evaluated by assignments, quizzes, and exams. This course has a separate mandatory laboratory session every week as PHY 108L.
Method(s) of Instruction(s)	Interactive lectures, Laboratory sessions

COURSE CONTENT BY MODULE

Module #1	**Electric Charge and Field**: Electric charge, Coulomb's Law, Electric field, Electric field lines, Electric field due to a point charge, electric dipole, line of charge and charged disk, Movement of charge in an electric field
Module #2	**Gauss' Law:** Flux, Gauss' Law, Application of Gauss' Law: Cylindrical, spherical, and planar symmetry
Module #3	**Electric Potential Energy:** Electric potential energy and electric potential, Equipotential surface, Calculating potential from the electric field, Potential due to a point charge and a group of point charges, Potential due to continuous charge distribution, Conductors in electrostatic equilibrium
Module #4	**Capacitors:** Capacitance, Capacitors in series and parallel, Energy stored in an electric field, Capacitors with a dielectric
Module #5	**Ohm's Law and Electric Circuit:** Electric current, resistance, and Ohm's law, Resistors in series and parallel, Power in electric circuits, Kirchhoff's laws and solving circuits, RC circuits
Module #6	**Magnetic Force and Field:** Magnetic force, Hall effect, Torque on a current loop, Magnetic field due to a current, Biot-Savart Law, Force between two parallel currents, Ampere's law, Solenoid
Module #7	**Induction:** Faraday's law of induction, Lenz's law, Induction and energy transfer, Induced electric field, Inductors and inductance, Self-induction, Energy stored in a magnetic field, Mutual induction, LR circuit
Module #8	**LC Oscillation:** LC circuit, Maxwell's Equations
Actual contact hours: 42 hours per semester	

TEXTBOOK REQUIREMENT

David Halliday, Robert Resnick, and Jearl Walker, *Fundamentals of Physics* (10th ed., 2013), John Wiley & Sons, Inc., New York, NY.

ASSESSMENT STRATEGY AND GRADING SCHEME

NSU's grading and performance evaluation policies will be followed in assigning the grade. Please note that all final grades are subject to departmental review and approval. A guideline of course assessment is as follows-

Class Attendance	Assignments/Projects	Quiz	Mid Term	Final
5%	10%	20%	30%	35%

MAPPING OF COURSE OUTCOMES

CLO-#	Outcome types	Bloom's taxonomy domain/level (C: *Cognitive* P: *Psychomotor* A: *Affective*	Delivery method	Assessment tools	
CLO #1	Calculate electrical quantities such as electric force, electric field, and electric flux using Coulomb's law and Gauss' law.	**C2, C3, P2**	Lecture, simulations and Discussion	Quiz, Assignment	Midterm Exam
CLO #2	Calculate the potential of distributions of electric charge and different combinations of electric charges using Coulomb law.	**C2, C3, P2**	Lecture, Simulations and Discussion	Quiz, Assignment	
CLO #3	Compute capacitance of simple capacitors and resistors as well as series, parallel and series-parallel arrangements of capacitors.	C2, C3, P2	Lecture, Simulations, and Discussion	Quiz and Assignment	Final Exam
CLO #4	Analyze Ohm's and Kirchhoff's laws by evaluating electric current and power in simple DC circuits involving resistors and batteries.	C4, P2	Lecture, Simulations and Discussion	Quiz and Assignment	
CLO #5	Analyze the effect of magnetic fields on the motion of an electric charge, as well as the force and torque on a current-carrying wire in a magnetic field.	C4, P2	Lecture, Simulations and Discussion	Quiz and Assignment	
CLO #6	Calculate the magnetic field due to currents in wires, coils, and solenoids using Biot-Savart law and Ampere's law.	C2, C3, P2	Lecture, Simulations and Discussion	Quiz and Assignment	
CLO #7	Apply Faraday's law of induction and Lenz's law to analyze induced emf and current as well as the phenomenon of self-induction and mutual induction.	C3, P2	Lecture, Simulations and Discussion	Quiz and Assignment	

LECTURE DETAILS:

Tentative lecture and examination schedule are given below. These may be changed/reordered if necessary.

L1- L2	Electric Charge, Coulomb's Law, Electric force between two and more charges, Electric field
L3 – L5	Electric field calculation for continuous charge distribution, Electric field lines, Dipole in an electric field, Torque, Motion of charge in an electric field, Charge quantization, Millikan Oil drop experiment
L6 – L7	Flux, Gauss's Law, Application of Gauss' law, Conductors in electrostatic equilibrium
L8 – L9	Electric potential energy and electric potential, Calculating potential from the field, Potential due to a point charge and a group of point charges, Equipotential surface
L10 – L11	Capacitance, Calculation of capacitance, Capacitors in series and in parallel, Energy stored in an electric field, Energy density, Effect of a dielectric on a capacitor

MIDTERM EXAM

L13 – L14	Electric current, Resistance and Ohm's law, Resistors in series and parallel, Power in electric circuits, Kirchhoff's laws and solving circuits, RC circuits
L15 – L16	Magnetic Force, Hall Effect, Magnetic force due to charge and current, Torque on a current loop
L17 – L18	Magnetic field due to current, Biot –Savart Law and its applications, Force between two parallel current carrying conductors, Ampere's law and its applications, Magnetic field due to a solenoid
L19 – L20	Faraday's Law of induction and Lenz's law, Motional EMF
L21 – L22	Inductors and inductance, Self-induction, Energy stored in a magnetic field, Mutual induction, LR circuit
L23 – L24	LC circuit and Maxwell's equations