



PART A: General Information

Description of Course PHY 173

- 1 **Course Title** : Optics, Electricity & Magnetism and Electrodynamics
- 2 **Type of Course** : Non-departmental course
- 3 **Offered to** : Department of Nanomaterials and Ceramic Engineering
- 4 **Pre-requisite Course(s)** : N/A

PART B: Course Details

1. Course Content (As approved by the Academic Council)

Combination of lenses, Aberrations, Defects of images, Dispersion, Optical instruments, Resolving power of optical instruments, Interference of light, Diffraction of light, Polarization of light; Electrostatic force and electric field, Electric potential, Capacitors and dielectrics, Kirchoff's law, Magnetic field, Ampere's law, Bio-Savart's law, Electromagnetic induction; Poisson's equations and Laplace's equations, Maxwell's equations and their applications, Displacement current, Energy in electromagnetic field: Poynting vector, EM wave: propagation in different media.

2. **Course Objectives**

- Objective 1: To develop logical and critical thinking with scientific knowledge of Optics, Electricity & Magnetism and Electrodynamics required for the students of Nanomaterials and Ceramic Engineering
- Objective 2: To understand the different laws of Physics associated with Optics, Electricity & Magnetism and Electrodynamics, and apply them to solve the real life problems.

3. Knowledge required

Insert previous knowledge requirements: N/A

4. **Course Outcomes**

CO No.	CO Statement	Corresponding PO(s)*	Domains and Taxonomy level(s)**	Delivery Method(s) and Activity(-ies)	Assessment Tool(s)
	At the end of the course, a student should be able to				
CO1	Describe the basic laws of Physics related to Optics, Electricity & Magnetism and Electrodynamics to express different phenomena in the physical world.	PO(a)	C1	e.g., Lectures, Homework	e.g., Written exams; viva voce; presentation; assignment
CO2	Explain the fundamental concepts and theories of Optics, Electricity & Magnetism and Electrodynamics applicable for different physical conditions.	PO(a)	C2	e.g., Lectures, Homework	e.g., Written exams; viva voce; presentation; assignment
CO3	Apply the relevant laws of physics to solve various mathematical problems and interpret the result and its consequences.	PO(a)	C3, C4	e.g., Lectures, Homework	e.g., Written exams; viva voce; presentation; assignment

***POs**

PO (a): Engineering knowledge; PO(b): Problem analysis; PO (c): Design/development of solutions; PO(d): Investigation; PO(e) Modern tool use; PO(f): Engineer and society; PO(g): Environment and sustainability; PO(h): Ethics; PO(i): Individual work and teamwork; PO(j): Communication; PO(k): Project management and finance; PO(l): life-long learning



****Domains**

C-Cognitive : C1: Knowledge; C2: Comprehension; C3: Application; C4: Analysis; C5: Synthesis; C6: Evaluation

A-Affective : A1: Receiving; A2: Responding; A3: Valuing; A4: Organizing; A5: Characterizing

P-Psychomotor: P1: Perception; P2: Set; P3: Guided Response; P4: Mechanism; P5: Complex Overt Response; P6: Adaptation; P7: Organization

5. Lecture Plan

wk	Lecture Topics	Corresponding CO(s)
1	<ul style="list-style-type: none"> Defects of images: Spherical aberration, Astigmatism, Coma 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 Introduction to Electrodynamics, Gradient, divergence, curl, 	CO1, CO2, CO3
2	<ul style="list-style-type: none"> Distortion, Curvature, Chromatic aberration Flux - Gauss' Law - Application of Gauss' Law: Cylindrical, spherical and planar symmetry line, surface, and volume integrals, Poisson's equation 	CO1, CO2, CO3
3	<ul style="list-style-type: none"> Solving mathematical problems related to aberration Electric potential energy and electric potential, Equipotential surface, Calculating potential from the field, Laplace's equation, Maxwell's equation in free space, 	CO1, CO2, CO3
4	<ul style="list-style-type: none"> Theories of light, Interference of light, Young's double slit experiment, Displacements of fringes and its uses Potential due to a point charge and a group of point charges, Potential due to continuous charge distribution, Conductors in electrostatic equilibrium Maxwell's equations in matter, linear isotropic media, harmonically varying fields 	CO1, CO2, CO3
5	<ul style="list-style-type: none"> Class Test (Optics) Capacitance - Capacitors in series and in parallel - Energy stored in an electric field - Capacitors with dielectric Solving mathematical problems for Maxwell's equation 	CO1, CO2, CO3
6	<ul style="list-style-type: none"> Fresnel bi-prism, Interference in thin films Electric current, resistance and Ohm's law - Resistors in series and parallel - Power in electric circuits - Kirchhoff's laws and solving circuits - RC circuits Charge and energy, the continuity equation 	CO1, CO2, CO3
7	<ul style="list-style-type: none"> Newton's rings, Interferometers Class Test (Electricity and Magnetism) Poynting's theorem, Maxwell's stress tensor 	CO1, CO2, CO3
8	<ul style="list-style-type: none"> Solving mathematical problems related to interference of light Magnetic fields, Hall effect, Biot-savart law, Torque on a current loop, Magnetic dipole moment Energy-Momentum conservation for Electromagnetic fields and charges 	CO1, CO2, CO3
9	<ul style="list-style-type: none"> Diffraction of light, Fresnel and Fraunhofer diffraction, Diffraction due to single slit Magnetic field due to a current, force between two parallel currents, ampere's law, solenoid Class Test (Electrodynamics) 	CO1, CO2, CO3
10	<ul style="list-style-type: none"> Diffraction from a circular aperture, diffraction at double slits Faraday's law of induction, Lenz's law, induction and energy transfer, induced electric field The wave equation, boundary conditions: transmittance and reflectance 	CO1, CO2, CO3
11	<ul style="list-style-type: none"> N-slits- Diffraction grating Inductors and inductance, self-induction, energy stored in a magnetic field, mutual induction, LR circuit 	CO1, CO2, CO3



	<ul style="list-style-type: none"> The wave equation for E and B, energy and momentum in electromagnetic waves 	
12	<ul style="list-style-type: none"> Resolving power of optical instruments, Solving mathematical problems related to diffraction of light Magnetic properties of matter, types of magnetic materials, application of magnetic materials Wave propagation in linear media, reflection and transmission at normal incidence/Oblique incidence 	CO1, CO2, CO3
13	<ul style="list-style-type: none"> Polarization of light, Production and analysis of polarized light, Brewster's Law, Malus law Hysteresis curve; electromagnetic oscillation: L-C oscillations and its analogy to simple harmonic motion. Class test -4 	CO1, CO2, CO3
14	<ul style="list-style-type: none"> Polarization by double refraction, Nicol prism, Optical activity, Polarimeters, Polaroid Mathematical problems related to magnetic field and magnetism Electromagnetic waves in conductors, reflection at conducting surface, applications of wave guides 	CO1, CO2, CO3

6. Assessment Strategy

- Class Participation: Class participation and attendance will be recorded in every class.
- Continuous Assessment: Continuous assessment any of the activities such as quizzes, assignment, presentation, etc. The scheme of the continuous assessment for the course will be declared on the first day of classes.
- Final Examination: A comprehensive term final examination will be held at the end of the Term following the guideline of academic Council.

7. Distribution of Marks

Class Participation	10%
Continuous Assessment	20%
Final Examination	70%
Total	100%

8. Textbook/ Reference

- Fundamentals of Optics, 4th Edition; Jenkins, and White.
- Physics for Engineers, Part 1 &2; **Gias Uddin Ahmad**.
- Fundamentals of Physics; David Halliday, Robert Resnick, and Jearl Walker,
- Introduction to Electrodynamics; David J. Griffiths
- Electrodynamics; **Gupta, Kumar, Singh**

Prepared by:		
Name: Course Teacher Signature:	Name: Course Teacher Signature:	Name: Course Teacher Signature:
Date of Preparation:November, 2022		
Date of Approval by BUGS:November, 2022		