

Course No: PHY 165 Level 1/ Term 2

Credit (Contact) Hours: 3.0

PART A: General Information

Description of Course PHY 165

1 Course Title : Electricity and Magnetism, Modern Physics and Mechanics

2 Type of Course : Non-departmental course

3 Offered to : Department of Electrical and Electronic Engineering

4 Pre-requisite Course(s) : N/A

PART B: Course Details

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

Electricity and magnetism: Electric charge and Coulomb's Law, Electric field, Concept of electric flux and the gauss's Law - some applications of gauss's Law, Gauss's Law in vector form, Electric potential, Relation between electric field and electric potential, Capacitance and dielectrics, Gradient, Laplace's and Poisson's equations, Current, Current density, Resistivity, The magnetic field, Ampere's Law, Biot-savart Law and their applications, Laws of electromagnetic induction- Maxwell's equations.

Modern Physics: Michelson-Morley's experiment, Galilean transformation, Special theory of relativity and its consequences; Quantum theory of radiation; Photo-electric effect, Compton effect, Wave particle duality, Interpretation of Bohr's postulates, Radioactive disintegration, Properties of nucleus, Nuclear reactions, Fission, Fusion, Chain reaction, Nuclear reactor.

Mechanics: Linear momentum of a particle, Linear momentum of a system of particles, Conservation of linear momentum, Some applications of the momentum principle; Angular momentum of a particle, Angular momentum of a system of particles, Kepler's Law of planetary motion, The Law of universal gravitation, The motion of planets and satellites, Introductory quantum mechanics; Wave function, Uncertainty principle, Postulates, Schrodinger time independent equation, Expectation value, Probability, Particle in a zero potential, Calculation of energy.

2. Course Objectives

Objective 1: To develop logical and critical thinking with scientific knowledge of electricity & magnetism, modern physics and mechanics required for the students of electrical and electronic engineering.

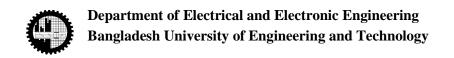
Objective 2: To understand the different laws of physics associated with electricity & magnetism, modern physics and mechanics, and apply them to solve the real life problems.

3. Knowledge required

Insert previous knowledge requirements: N/A

4. Course Outcomes

CO	CO Statement	Corresponding	Domains	Delivery	Assessment Tool(s)
No.		PO(s)*	and	Method(s) and	
	At the end of the course, a student		Taxonomy	Activity(-ies)	
	should be able to		level(s)**		
CO1	Describe the basic laws of physics related to electricity & magnetism, modern physics and mechanics to express different phenomena in the physical world.	PO 1	C1	e.g., Lectures, Homework	e.g., Written exams; viva voce; presentation; assignment
CO2	Explain the fundamental concepts and theories of electricity & magnetism, modern physics and mechanics applicable for different physical conditions.	PO 2	C2	e.g., Lectures, Homework	e.g., Written exams; viva voce; presentation; assignment



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CO3	Apply the relevant laws of physics to	PO 3	C3, C4	e.g., Lectures,	e.g., Written exams;
	solve various mathematical problems			Homework	viva voce;
	and interpret the result and its				presentation;
	consequences.				assignment

*POs

PO 1: Engineering knowledge; PO 2: Problem analysis; PO 3: Design/development of solutions; PO 4: Investigation; PO 5: Modern tool use; PO 6: Engineer and society; PO 7: Environment and sustainability; PO 8: Ethics; PO 9: Individual work and teamwork; PO 10: Communication; PO 11: Project management and finance; PO 12: 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	 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 Frame of reference, Failure of Newtonian mechanics, Galilean transformation, Concept of ether Linear momentum of a particle, Linear momentum of a system of particles, Conservation of linear momentum, Some applications of the momentum principle 	CO1, CO2
2	 Flux - Gauss' Law - Application of Gauss' Law: Cylindrical, spherical and planar symmetry Michelson-Morley experiment, consequence of Michelson-Morley experiment Angular momentum of a particle, Angular momentum of a system of particles, Kepler's Law of planetary motion 	CO1, CO2, CO3
3	 Electric potential energy and electric potential, Equipotential surface, Calculating potential from the field Derivation of Lorentz transformation equations, relativity of length, time and mass The Law of universal gravitation, The motion of planets and satellites 	CO1, CO2, CO3
4	 Potential due to a point charge and a group of point charges, Potential due to continuous charge distribution, Conductors in electrostatic equilibrium Mass-Energy relation, relativistic addition of velocities, relativity of simultaneity Introductory quantum mechanics Wave function, Schrodinger equation 	CO1, CO2, CO3
5	 Capacitance - Capacitors in series and in parallel - Energy stored in an electric field - Capacitors with dielectric Class Test (Modern Physics) Postulates of quantum mechanics, probability density, normalization of wave function, mathematical problem 	CO1, CO2, CO3
6	 Class Test (Electricity and Magnetism) Theory of light, Planck's quantum theory, photo-electric effect, characteristics (laws) of photoelectric emission Mathematical Problem on Normalization of wave function 	CO1, CO2, CO3
7	 Electric current, resistance and Ohm's law - Resistors in series and parallel - Power in electric circuits - Kirchhoff's laws and solving circuits - RC circuits Failure of wave theory of light to explain photoelectric effect, Einstein photoelectric equation, determination of Planck's constant, light-matter interaction, applications of photo-electric effect Expectation values, quantum mechanical operator, mathematical problem 	CO1, CO2, CO3

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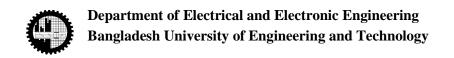
8	 Magnetic fields, Hall effect, Biot-savart law, torque on a current loop, magnetic dipole moment Compton effect, Compton theory, Wave particle duality/de-Broglie hypothesis, Determination of de-Broglie wavelength Time independent Schrodinger equation, stationary states 	CO1, CO2, CO3
9	 Magnetic field due to a current, force between two parallel currents, ampere's law, solenoid Limitation of Rutherford's atom model, postulates of the Bohr atomic model, limitation of Bohr's atom model, de-Broglie atom model Class Test (Quantum Mechanics) 	CO1, CO2, CO3
10	 Faraday's law of induction, Lenz's law, induction and energy transfer, induced electric field Properties of nucleus: static nuclear properties and dynamic properties, mass defect, binding energy, binding energy per nucleon, nuclear force Properties of stationary states and mathematical problem 	CO1, CO2, CO3
11	 Inductors and inductance, self-induction, energy stored in a magnetic field, mutual induction, LR circuit Nuclear chain reactions, Different condition for nuclear chain reactions, Nuclear fission, Nuclear fusion, Little Boy: A gun-type bomb, Fat Man: Implosion-type bomb Particle in an infinite square well potential: wave function and energy 	CO1, CO2, CO3
12	 Magnetic properties of matter, types of magnetic materials, application of magnetic materials Nuclear power reactor, different parts of nuclear fission reactor, types of fission reactor, nuclear fusion reactor, types of fusion reactor Mathematical problem on infinite square well potential 	CO1, CO2, CO3
13	 Hysteresis curve; electromagnetic oscillation: L-C oscillations and its analogy to simple harmonic motion. Difficulties against using nuclear fusion, nuclear models, the liquid drop model, semi-empirical mass formula Particle in a zero potential: wave function and energy 	CO1, CO2, CO3
14	 Mathematical problems related to magnetic field and magnetism The shell model, radioactivity, radioactive transformation, decay law, average life period of a radioelement Mathematical problems related to zero potential 	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%



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8. Textbook/ Reference

- Fundamentals of Physics (10th Edition), D. Halliday, R. Resnick, and J. Walker
 Concepts of Modern Physics (6th edition); A. Beiser.
 Quantum Mechanics, (2nd Edition), David J. Griffith
 Physics for Engineers -Part-2; Giasuddin Ahmad

Prepared by:					
Name: Course Teacher	Name: Course Teacher	Name: Course Teacher			
Signature:	Signature:	Signature:			
Date of Preparation: 29 May, 2022					
Date of Approval by BUGS: 01 June, 2022					