

PHY-112
PRINCIPLES OF PHYSICS-II
AKIFUL ISLAM (AZW)
SPRING-24

WHAT DO YOU NEED TO BEGIN?

- Pre-requisite: **PHY-111**
- Vector Algebra: Addition and Subtraction
- Vector Resolution: Geometric and Analytical
- Vector Multiplication: Dot and Cross-Product
- Abstract Idea of Fields: Vector and Scalar Fields
- Vector Calculus: Gradient, Divergence, Curl
- Work Done, Energy, Power
- Work-Energy Theorem and Conservation of Energy
- Torque and Rotational motion
- Co-requisite: **MAT-110** and **MAT-120**

SYLLABUS

- Part 1: **Electric** Fields.
- Part 2: **Magnetic** Fields.
- Part 3: Uniting **Electric** and **Magnetic** Fields.
- Part 4: **Electromagnetic** Fields.

PART 1: ELECTRIC FIELDS.

ELECTROSTATICS

- How is Electric Field Created?
- Electric Charge: Micro and Macroscopic. Properties of Charges
- Electric Charge Distribution: Discrete and Continuous
- Electrostatic Forces
- Coulomb's Law of Electrostatics
- Introduction to \vec{E} -Field: Field Lines and Intensity
- Charged Particles in \vec{E} -Field: Straight and Parabolic Deflection

ELECTROSTATICS

- Electric Field due to a (Point) Charged Particle
- Electric Field Intensity Measurements for Charge Distributions: Line, Ring, Disk, Plane. (Integration Heavy)
- Gauss's Law of Electrostatics
- Electric Flux: Uniform and Non-Uniform
- Applications of Gauss's Law: Line, Ring, Disk, Plane Charges
- List the 1st Maxwell's Equation

ELECTROSTATICS

- Work Done due to Electrostatic Force
- Electric Potential Energy
- Electric Potential
- Electric Potential Measurements for Charge Distributions:
Line, Ring, Disk, Plane. (Integration Heavy)
- Equipotential Surfaces
- Capacitance and Capacitors
- Energy Stored in \vec{E} -Field

MID-TERM

ELECTRIC CIRCUIT

- What's the point of an Electric Circuit?
- Electric Current: Microscopic View
- Ohm's Law and Conducting Materials
- Electromotive Force (EMF)
- Power in(out)put from Electric Circuits
- Electric Circuit Elements
- Solving DC Circuits: Kirchoff's Laws
- Transient Series RC Circuits: Charging and Discharging of a Capacitor

PART 2: MAGNETIC FIELDS

MAGNETOSTATICS

- How is Magnetic Field Created?
- Biot-Savart Law
- Electric Field Intensity Measurements for Current Distributions: Straight Wire, Curved Wire, Wire Loop. (Integration Heavy)
- Magnetic Field of a Current Loop and Electromagnet

MAGNETOSTATICS

- Magnetic Force Caused by \vec{B} -Fields on Wires: Single Point Charge, Straight Wire, Wire Loop
- Charged Particles in \vec{B} -Field: Circular Deflection, Cathode Ray Experiment, Particle Accelerators, Hall Effect
- Gauss's Law for Magnetostatics
- Magnetic Flux
- Ampère's Law and its application: Current Distribution, Solenoid, Toroid
- List the 2nd Maxwell's Equation

PART 3: UNITING ELECTRIC AND MAGNETIC FIELDS

ELECTROMAGNETISM

- Electromagnetic Induction: Induced EMF and Induced Current
- Faraday's Law of Induction
- Lenz's Law
- Inductance and Inductors
- Energy Stored in \vec{B} -Field
- Transient Series RL Circuits
- List the 3rd Maxwell's Equation

ELECTROMAGNETIC OSCILLATION

- Series LC Circuits
- Series RLC Circuits
- Alternating Current & Forced EM Oscillation
- Phasors and Phasor Diagrams
- Alternating Signals in 3 simple circuits: Capacitive, Resistive, Inductive
- Characteristic Phasor Diagrams for all 3 Circuits

PART 4: A GLIMPSE OF ELECTRODYNAMICS

ELECTROMAGNETIC WAVES

- Displacement Current and Ampère-Maxwell Law
- List the 4th Maxwell's Equation
- Generate and Propagate the Electromagnetic Wave: LIGHT

FINAL

WHY DO YOU NEED THIS COURSE?

- The **Math** part makes You think like a programmer
- The **Physics** part builds You a better problem-solving mindset

RESOURCES

- In-Person Classes (Main Food)
- Consultation Hours (Supplimentary Vitamins)
- Reference Books
- Exercise Problem List
- Student Tutor
- Each Other
- The Internet

HOW TO ACE THIS COURSE?

- Pay Attention to every small detail
- Test Yourself constantly
- Do more of what works
- Do less of what does not
- Do not let things **pile up!!**
- Respect your time, brain and willpower
- Rinse and Repeat

GOOD LUCK!