



# **PHY-112 | PRINCIPLES OF PHYSICS-2**

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Fall 2024 | Class #0

DEPARTMENT OF MATHEMATICS & NATURAL SCIENCES

Inspiring Excellence

## **INTRODUCTION**



# INTRODUCTION

## ASSESSMENT RUBRIC



### How will your performance be assessed?

- ▶ 05%  $\implies$  Attendance
- ▶ 15%  $\implies$  Averaging 4 Quizzes (15 marks each)
- ▶ 15%  $\implies$  Averaging 4 Assignments (15 marks each)
- ▶ 20%  $\implies$  Mid-term examination (20 marks)
- ▶ 10%  $\implies$  Laboratory experiments (10 marks)
- ▶ 35%  $\implies$  Final examination (35 marks)

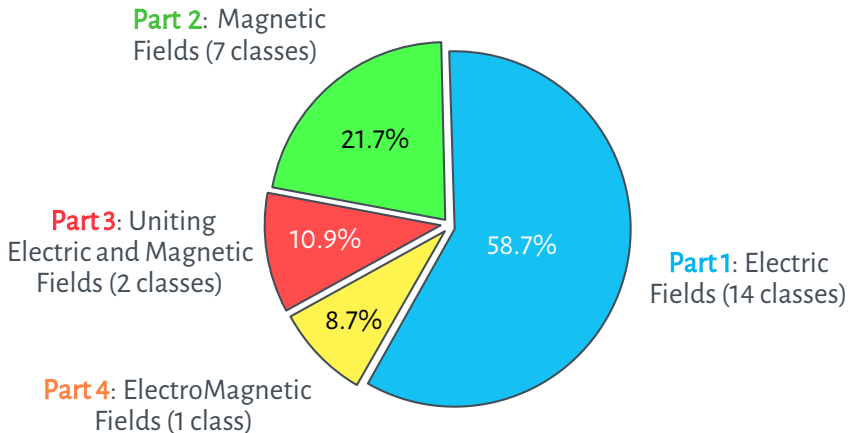
**NOTE:** There will be No Bonus Assessments! You have one shot at this. Make it count!

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## **SYLLABUS & PREREQUISITES**

# SYLLABUS

## HOW THE COURSE IS STRUCTURED



# SYLLABUS

## HOW THE COURSE IS STRUCTURED



### Part 1: Electric Fields (6 classes)

- ▶ Electric Charge: Micro and Macroscopic. Properties of Charges
- ▶ Electric Charge Distribution: Discrete and Continuous
- ▶ Electrostatic Forces
- ▶ Coulomb's Law of Electrostatics
- ▶ How is Electric Field Created?
- ▶ Introduction to  $\vec{E}$ -Field: Field Lines and Intensity
- ▶ Charged Particles in  $\vec{E}$ -Field: Straight and Parabolic Deflection
- ▶ Gauss's Law of Electrostatics
- ▶ Electric Flux: Uniform and Non-Uniform
- ▶ Applications of Gauss's Law: Line, Plane Charges
- ▶ List the 1<sup>st</sup> Maxwell's Equation

# SYLLABUS

## HOW THE COURSE IS STRUCTURED



### Part 1: Electric Fields (5 classes)

- ▶ Work Done due to Electrostatic Force
- ▶ Electric Potential Energy
- ▶ Electric Potential Intuition
- ▶ Electric Potential Measurements for Charge Distributions: Point, Line, Plane. (Integration Heavy)
- ▶ Equipotential Surfaces
- ▶ Capacitance and Capacitors: With and without Dielectrics
- ▶ Energy Stored in  $\vec{E}$ -Field

**Mid-Term will be up until this.**

# SYLLABUS

## HOW THE COURSE IS STRUCTURED



### Part 1: Electric Fields (3 classes)

- ▶ 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 Introduction and Elements
- ▶ Solving DC Circuits: Kirchhoff's Laws
- ▶ Transient Series  $RC$  Circuits: Charging and Discharging of a Capacitor



# SYLLABUS

## HOW THE COURSE IS STRUCTURED



### Part 2: Magnetic Fields (7 classes)

- ▶ How is Magnetic Field Created? Intuition with examples.
- ▶ Biot-Savart Law
- ▶ Magnetic Field Intensity Measurements for Current Distributions: Straight Wire, Wire Loop.
- ▶ Magnetic Field of a Current Loop and Electromagnet
- ▶ Magnetic Force Caused by  $\vec{B}$ -Fields on Wires: Single Point Charge, Straight Wire, Wire Loop
- ▶ Charged Particles in  $\vec{B}$ -Field: Circular Deflection, Cyclotron
- ▶ Gauss's Law for Magnetostatics: Magnetic Flux
- ▶ Ampère's Law and how to use it
- ▶ List the 2<sup>nd</sup> Maxwell's Equation

# SYLLABUS

## HOW THE COURSE IS STRUCTURED



### Part 3: Uniting Electric & Magnetic Fields (2 or 3 classes)

- ▶ ElectroMagnetic Induction: Induced EMF and Induced Current
- ▶ Faraday's Law of Induction & Lenz's Law
- ▶ Inductance and Inductors
- ▶ List the 3<sup>rd</sup> Maxwell's Equation

### Part 4: ElectroMagnetic Fields (1 of 0.5 class)

- ▶ Displacement Current and Ampère-Maxwell Law
- ▶ List the 4<sup>th</sup> Maxwell's Equation
- ▶ Generate and Propagate the ElectroMagnetic Wave: LIGHT

**Final will contain 10-15% of Mid Syllabus.**

# PREREQUISITES

WHAT YOU NEED TO ACE THE COURSE!



## ► Pre-requisite: **PHY-111**

- **Vector Resolution:** Geometric and Analytical
  - Breaking any vector down
- **Vector Algebra:** Addition and Subtraction
  - Superposition of forces and fields
- **Vector Multiplication:** **Dot** and **Cross-Product**
  - Electric and Magnetic Flux (Dot)
  - Biot-Savart Law and Magnetic Forces (Cross)
- **Intuition of Fields:** **Vector and Scalar Fields** in 3D
  - Electric and Magnetic Fields
- **Work Done and Conservation of Energy**
  - Electric Potential Energy
  - Motion of charged particles

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## **WHAT TO AND NOT TO EXPECT!**

# RESOURCES

## WHAT TO USE?



- ▶ In-Person Classes (Main Food)
- ▶ Consultation Hours (Supplementary Vitamins)
- ▶ Reference Books (Will be provided in Slack)
- ▶ Exercise Problem List (Will be provided in Slack)
- ▶ Student Tutor
- ▶ Each Other
- ▶ The Internet

# RESOURCES

## HOW TO USE?



- ▶ Pay *effective* Attention to in-person classes every small detail matters. Do not leave out everything for consultation hour
- ▶ Test Yourself constantly: Solve **practice problems**
- ▶ 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

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**That is it for today!**

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