**ELE1201 Electricity and Magnetism**

| Period per Week | | | Contact Hour per Semester | Weighted Total Mark | Weighted Exam Mark | Weighted Continuous Assessment Mark | Credit Units |
|---|---|---|---|---|---|---|---|
| LH | PH | TH | CH | WTM | WEM | WCM | CU |
| 45 | 00 | 15 | 60 | 100 | 60 | 40 | 4 |

**Rationale**

Electromagnetic interactions play a central role in determining the structure of the natural world and are the foundation of most current and emergent technology, therefore a basic understanding of electricity and magnetism (E&M) is important. In E&M the student is quickly introduced to a world in which almost all of the quantities are invisible; they are either microscopic such as electrons or abstractions such as field, flux, and potential. Integral calculus becomes a central mathematical tool, and students are asked to apply it in unfamiliar ways, such as calculating the path integral or surface integral of a quantity expressed as a vector dot product. It is necessary for students to think and visualize in three dimensions.

**Objectives**

- This course aims to give the fundamentals of Electricity and Magnetism by introducing the basic concepts and applications of vector calculus.
- It aims to attach quantitative meaning to the previously qualitatively studied laws in this topic.

**Course Content**

***1. Vector Algebra***

- Definitions: Scalars, Vectors, Unit Vector, and Dimensionality
- Operations on Vectors: Addition, Subtraction, Multiplication, Dot and Cross Products
- Position and Distance vectors

***2. Vector Analysis***

- Scalar and Vector Fields
- Classification of vector fields
- Scalar and Vector Functions
- Directional Derivatives of Scalar Functions and Derivatives of Vector Functions
- Gradient, Divergence, Curl and Laplacian of Vector Functions
- Physical Interpretation of the Divergence and the Curl of a Vector Field
- Green's theorem, Line Integrals Independent of Path, Exact Differential Forms
- Differential length, Area and Volume; Line, surface and Volume integrals
- Coordinate systems and Transformation: Cartesian; Cylindrical; Spherical coordinate

***3. Electrostatic Fields***

- Coulomb's Law & Field Intensity
- Electric Field due to Continuous Charge Distribution
- Electric flux density
- Gauss' Law-Maxwell Equation
- Electric potential
- Relationship between E and V
- Energy stored in Electric field

**Learning Outcomes**

The course participant is able to attach quantitative meaning to the basic laws of Electricity and Magnetism, and also able to give daily-life analogies to the concepts studied. The student applies the electricity and magnetism laws studied to explain real situations.

**Reference Material**

*[1]* Matthew N.O. Sadiku, *Elements of Electromagnetics*, 3rd ed.,Oxford University Press, 2001

*[2]* Sears F., Zemansky M., Young H., *Electricity,Magnetism and Optics*.

*[3]* Murray R Spiegel, *Theory and Problems of Vector Analysis*, SI (Metric) ed., McGraw Hill

*[4]* William H. Hayt, Jr., *Engineering Electromagnetics*, 5th ed., Tata McGraw-Hill, New Delhi, 1997