BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani

Pilani Campus

First Semester 2018-2019
Instruction Division
Course Handout (Part II)

Date: 02/08/2018

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No. : **PHY F212**
Course Title : **Electromagnetic Theory I**
Instructor In-charge : **Jayendra N. Bandyopadhyay**
Instructor(s) :**SubhashisGangopadhyay and Jayendra N. Bandyopadhyay**

1. Course Description

Electromagnetic Theory I is the first of the two courses on Electromagnetic Theory to be offered to Physics students. It is also a mandatory course for Chemistry students. It is an elementary course and it deals with Electrostatics, Magnetostatics, and basics of Electrodynamics.

2. Scope and Objectives

- To learn the mathematical tools to solve all problems of electomagnetism
- Understand the concept of electric field
- Learn to solve electrostatic problems using the concept of potential
- Understand how electric field gets modified in materials
- Understand the concept of magnetic field
- Understand how magnetic field gets modified in materials
- Understand the magnetic induction and introduction of Electrodynamics
- Introduction of Maxwell's equations and electromagnetic waves

3. Prescribed Text Book

T1. *Introduction to Electrodynamics",* David J.Griffiths, Forth Edition, Pearson Education Inc., 2014.

4. Reference Book

R1. "*PHYSICS",Vol. 2,* David Halliday,Robert Resnick and Kenneth S. Krane, Fifth edition, John Wiley & Sons, Inc., 2002.

5. Course Plan

Module Number	Lecture session/Tutorial session	Reference	Learning Outcome
1. Introduction of basic mathematics	L1.1 Vectoralgebra L1.2-1.3 Differentialvectorcalculus L1.4 -1.5 Integralvectorcalculus L1.6 The Dirac Delta function T1.1-1.2Problemsolving session	T1 1.1-1.3, 1.5	Understanding of basic mathematicswhichwill berequired to solvedifferentproblems of electromagnetictheory
2. Electrostatics in free space	L2.1 The electricfield L2.2-2.3 Divergence and curl of electrostaticfields L2.4-2.5 Electric potential L2.6 Work and energy in electrostatics L2.7 Conductors L2.8-2.9 A special technique to solveelectrostaticproblems: Multipole expansion T2.1-2.3Problemsolving session	T1 2.1-2.5, 3.4	Understanding of the concept of the electricfield due to a collection of static charges and to calculate the electricfield due to different distribution of charges.
3. Electrostatics in matter	L3.1 Polarization L3.2 The field of a polarizedobject L3.3 The electricdisplacement L3.4-3.6 Lineardielectrics T3.1-3.2 Problemsolving session	T1 4.1-4.4	Understanding of the behavior of the electricfieldinsidematter. Effect of electricfield on the dielectricmaterials.
4. Magnetostatics in free space	L4.1 The Lorentz force L4.2-4.3 The Biot-Savartlaw	T1 5.1-5.4	Understanding of the concept of magneticfield due to the presence of

	L4.4-4.6 The divergence and curl of the magneticfield L4.7-4.8 The magneticvectorpotential T4.1-4.2 Problemsolving session		steadycurrents. Learn to calculate the magneticfield due to different configuration of currentcarryingwire.
5. Magneticfields in matter	L5.1 Magnetization L5.2 The field due to magnetizedobject L5.3-5.4 The auxiliaryfield L5.5. Linear and nonlinearmagneticmaterials T5.1 Problemsolving session	T1 6.1-6.4	Understanding of the behavior of the magneticfieldinsidematterial. Effect of magneticfield on the magnetizedmaterial.
6. Electrodynamics	L6.1-6.2 Ohm'slaw and Electromotive force L6.3-6.4 Electromagnetic induction T6.1 Problemsolving session	T1 7.1-7.2	Understanding of the effect due to moving charges and movingcharges in materials. Introduction of the concept of electromagnetic induction and its applications.
7. Maxwell'sequations	L7.1 Electrodynamicsbefore Maxwell and Maxwell contribution in electromagnetictheory L7.2-7.3 Maxwell'séquations T7.1 Problemsolving session	T1 7.3	Undestanding of the contribution of Maxwell in electromagnetictheory and its applications in the future generation

6. Evaluation Scheme:

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Evaluation Components	Weightage (%)	Date & Time	Remarks
Mid-semester test	30	11/10 9:00 - 10:30 AM	Closed book
Tutorials	30		Closed book. Total **five** tests will be conducted, of which best **four** would be counted.
Comprehensive	40	6/12 FN	Closed and Open book.

After completing this course the students will be able to

1) understand the concept of the electric and magnetic fields in free space,
2) understand the behavior of the electric and magnetic fields inside matter,
3) learn to calculate electric field and magnetic field for different cases,
4) understand the relationship between the electric and magnetic fields,
5) and understand the basics of electrodynamics.

Closed Book Test: No reference material of any kind will be permitted inside the exam hall.

Open Book Exam: Use of the textbook (T1) and reference book (R1) will be allowed. Photocopy of these books will also be allowed. Besides, only **hand-written class notes** are permitted. Use of calculators will be allowed in all exams. No exchange of any material will be allowed during exams.

Note:

It shall be the responsibility of the individual student to be regular in maintaining the self study schedule as given in the course handout, attend lectures and the lab demonstration as per the schedule announced in Nalanda. Mid Semester Test and Comprehensive Examination are according to the Evaluation Scheme given in the respective Course Handout. If the student is unable to appear for the Regular Test/Examination due to genuine exigencies, the student must refer to the procedure for applying for Make-up Test/Examination. No make up for the tutorials.

(Jayendra N. Bandyopadhyay)
Instructor In charge
PHY F212.