BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
SECOND SEMESTER 2014-2015
Course Handout (Part II) Date: 05/01/2016

In addition to part I (General Handout for the course append to the time table) this portion gives further specific details regarding course.

Course No. **: PHY F241**
Course Title **: Electromagnetic Theory II**
Instructors **: Jayendra N. Bandyopadhyay & R. R. Mishra**

1. Course Description : The course constitutes the second half of a comprehensive course on electromagnetic theory. It covers the following main topics - Review of Maxwell's equations in matter, Conservation Theorems of Electrodynamic systems, Propagation of plane electromagnetic waves in material media, Electromagnetic radiation, Relativistic formulation of electrodynamics, Radiation damping

2. Scope and objective : The course will take as staring point Maxwell's equations, which form the core of electrodynamics, and go through certain implications of these equations, namely, conservation theorems for an electromagnetic system, propagation of electromagnetic waves in material media, electromagnetic radiation. It will also include the relativistic formulation and corrections of classical electrodynamics.

3. Text Book: David Griffiths, J., Introduction to Electrodynamics, PHI Learning Private Limited, 3rd Ed., 2010.

4. Reference Books :
Reitz & Millford, Foundations of Electromagnetic Theory, Narosa Pub. House, 3rd Ed., 1997.

5. Course Plan:

Lecture Number	Learning Objectives	Topics to be Covered	References (Chap/Sec)
1-2	Introduction	Introduction and philosophy of Maxwell's theory	Class Notes
3-7	Solution of boundary value problems: Laplace's equation	General discussion on PDE. Laplace's equation in rectangular, spherical, and cylindrical coordinates	Sec. 3.3 & Class notes
8-11	Solution of boundary value problems: Poisson's equation	General discussion on Green's function, and its use in solving Poisson's equation	Class Notes
12–14	Conservation laws in Electromagnetic systems	Poynting theorem and conservation of energy, Maxwell stress tensor, conservation of linear and angular momentum	Sec. 8.1, 8.2
15–19	Guided waves	Wave guides, Rectangular wave guides, Coaxial transmission lines	Sec. 9.5
20–24	Potentials and Fields	Potential formulation of Maxwell's equations, Gauge transformations,	Sec. 10.1 – 10.3

		Retarded potentials, Lienard–Wiechert potential, Fields of a moving point charge	
25–28	Electromagnetic Radiation	Electric dipole radiation, Magnetic dipole radiation, Radiation from an arbitrary source	Sec. 11.1
29–31	Radiation from a point charge	Radiation from an accelerated point charge, Radiation reaction	Sec. 11.2
32–36	Special theory of relativity	Basic postulates of relativity, Lorentz transformations and structure of space-time	Sec. 12.1
37–38	Relativistic dynamics of a point particle	Generalization of Newton's equations of motion, Energy and momentum of a particle, Relativistic kinematics	Sec. 12.2
39–42	Covariant formulation of classical electrodynamics	4- vectors and tensors, Electromagnetic field tensor and transformation of electromagnetic fields, Covariance of Maxwell's equations	Sec. 12.3

6. Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage (%)	Date, Time & Venue	Nature of Component
1	Mid-Sem test	90 minutes	30%	18/3 2:00 -3:30 PM	Closed Book
3	5 Tutorial Tests (Announced)	30 minutes (each)	30%	To be announced a week before the test	Closed Book
3	Comprehensive Examination	3 hours	40%	13/5 FN	Partly Closed and Partly open book

7. Chamber Consultation Hour: To be announced in class.

8. Notices: Notices for the course will be put on FD **III** and physics department notice boards.

9. Make-up Policy: Make up will be given only in cases of sickness or urgency for going out of Pilani.

Instructor-in-charge
PHY F241