BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus,
AUGS/ AGSR Division

SECOND SEMESTER 2020-21
COURSE HANDOUT

Date: 18/01/2021

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 **: Madhukar 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, Conservation Theorems of Electrodynamic systems, 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, 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.
J D Jackson, Classical Electrodynamics, 3 rd Edition, Wiley Student Edition

5. Course Plan:

Lecture Number	Learning Objectives	Topics to be Covered	References (Chap/Sec)
1	Introduction, Review of Maxwell's equations	Review of Maxwell's equations in free space, wave propagation equations	Class notes
2 – 6	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
7 – 13	Potentials and Fields	Potential formulation of Maxwell's equations, Gauge transformations, Retarded potentials, Lienard – Wiechert potential, Fields of a moving point charge	Sec. 10.1 – 10.3
14 – 20	Radiation from a point charge	Radiation from an accelerated point charge, Radiation reaction	Sec. 11.2
21 – 29	Dipole Radiation	Electric dipole radiation, Magnetic dipole radiation, radiation from arbitrary source.	Sec. 11.1
29 – 33	Special theory of relativity	Basic postulates of relativity, Lorentz transformations and structure of space-time	Sec. 12.1
34 – 36	Relativistic dynamics of a point particle	Generalization of Newton's equations of motion, Energy and momentum of a particle, Relativistic kinematics	Sec. 12.2
37 – 40	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%	To be communicated by AUGSD	Closed/Open Book* *(Open, if it is conducted in online mode)
2a	4 Tutorial Tests (each of 20 Marks) (Announced)	20 minutes (each)	(Best three out of four Tut. Tests) 20 %	To be announced a week before the test	Closed/Open Book* *(Open, if it is conducted in online mode)
2b	2 Assignments (Each of 15 Marks)	1 week	Each equivalent to 1 Tutorial Test; 10 %	To be announced a week before the submission of assignment	Open Book
3	Comprehensive Examination	3 hours	40%	To be communicated by AUGSD	Closed/Open book* *(Fully Open, if it is conducted in online mode, otherwise partly open)

7. Chamber Consultation Hour: Tuesday; 5:00 PM – 6:00 PM.
Feel free to drop an email to IC (madhukar@pilani.bits-pilani.ac.in), in case of any issue/doubt/query.

8. Notices: All the notices will be displayed on **Google Classroom/Nalanda/Email**.

9. Make-up Policy: Very strict Make up policy will be followed. It will be given only in very genuine cases like, serious illness/hospitalization or visiting out of Pilani due to any urgent work.

Instructor-in-charge
PHY F241