BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE - PILANI, K K BIRLA GOA CAMPUS

INSTRUCTION DIVISION

First Semester 2018–2019

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 Handout (Part II)

Date: 02.08.2018

Course No. : **PHY/EEE/INSTR F212**
Course Title : **Electromagnetic Theory - I**
Instructor in Charge : Kinjal Banerjee
Instructors : E.S. Kannan,
Chandradew Sharma,
Raghunath Ratabole,
Prasanta Kumar Das

Course Description:

The course aims at providing a strong foundation in fundamental concepts of electromagnetic theory and its application. This course will provide provide the mathematical tools and physical concepts needed to understand and explain electrostatic, magnetostatic and simple electromagnetic phenomena

Text Books:

T1. *Introduction to Electrodynamics* by David J Griffiths. (4^{th} Edition) Prentice Hall India

Reference Books:

R1. *Foundations of Electromagnetic Theory* by John R Reitz, Fredrick J Millford & Robert W. Christy, 4^{th} Edition , Pearson Education, 5^{th} Reprint

R2. *Electricity & Magnetism: Berkeley Physics Course* SIE Vol. 2, 2^{nd} Edition, Tata McGraw Hill 2007

Evaluation Scheme:

Evaluation Component	Evaluation type	Date & Time	Wtg %	Remarks
Attendance in Tutorial classes	Attendance will be taken before commencement of tutorial	All Tutorial days	0 %	< 70 % attendance
			2%	70 – 85 % attendance
			5%	> 85 % attendance
Quiz	Objective type questions	3 Quizzes with 5% weightage each. Dates to be announced on LMS	15%	Closed Book
Mid semester Exam	Descriptive type questions	10th October 9 am to 10.30 am	30%	Open Book
Student Project	Demonstration of working model which illustrates simple concepts in EMT	Date to be announced later	10%	**See separate instructions**
Compre	Objective and Descriptive type questions	1st December 2:00pm to 5:00pm	40%	Closed Book

Course Plan:

Lecture Nos.	Topic to be covered in Lecture	Lecture Title	Ref.
1	Scalar Fields & Vector Fields; Curvilinear Coordinates; Differentiation & Integration of scalar & vector fields	Fields and coordinate system	Chapter 1: Griffiths
2	Operations of Gradient, Divergence & Curl; Intrinsic nature of differential operations	Differential Calculus	Chapter 1:

			Griffiths
3	Gradient Theorem; Divergence Theorem; Stoke's Theorem; Dirac Delta Function	Integral Calculus	Chapter 1: Griffiths
4	Coulomb's Law; Differential Formulation; Integral formulation; Interface conditions	Law of electrostatics	Chapter 2: Griffiths
5	Potential formulation of electrostatics; Electrostatic Energy	Scalar potential and energy in electrostatics	Chapter 2: Griffiths
6	Concept of boundary value problem; Uniqueness Theorems	Electrostatic Boundary Value Problem	Chapter 3 Griffiths
7	Basic material characteristics; Properties of electrostatic fields associated with conductors; Concept of Capacitance	Conducting Media	Chapter 2: Griffiths
8	Multipole expansion; Field due to an Electric Dipole; Influence of external field	Electric Dipole	Chapter 4: Griffiths
9	Dipole moments associate with atoms; molecules & solids; Concept of Polarization; Field due to a polarized body	Polarization	Chapter 4: Griffiths
10	Laws of electrostatics inside material media; Electric displacement; Interface Conditions	Electric Displacement	Chapter 4: Griffiths
11	Different types of dielectric media; Permittivity & dielectric constant	Dielectric Media	Chapter 4: Griffiths
12	Biot-Savart Law, Differential formulation of the laws of magnetostatics; Integral formulation of the laws of magnetostatics; Interface Conditions	Laws of Magnetostatics	Chapter 5: Griffiths
13	Concept of vector potential; Potential formulation of magnetostatics; Magnetostatic Energy; Concept of Inductance	Vector Potential	Chapter 5 Griffiths
14	Multipole expansion; Field due to a magnetic dipole; Influence of external fields	Magnetic Dipole	Chapter 5 Griffiths
15	Dipole moments associated with atoms, molecules & solids; Concept of Magnetization; Field of a magnetized body	Magntization	Chapter 6 Griffiths
16	Laws of magnetostatics inside magnetic media; the H field; Interface conditions	The H Field	Chapter 6 Griffiths
17	Different types of magnetic media; Diamagnetism, Paramagnetism; Permeability; Ferromagnetism	Magnetic Media	Chapter 6 Griffiths
MIDSEM			
19	Moving conductors in magnetic fields; Examples	Motional EMF	Chapter 7 Griffiths
20	Experimental investigations by Faraday; Faraday's law;	Electromagnetic	Chapter

	Differential and Integral (Circuit) form	Induction & Faraday's Law	7 Griffiths
21	Insight by Maxwell; Displacement current term; Physical implications due to the modification to Ampere's law	Modification to Ampere's Law	Chapter 7 Griffiths
22	Energy in electric and magnetic fields; understanding magnetostatic energy	Electromagnetic Energy	Chapter 7 Griffiths
23	Final form of Maxwell's equations in vaccum; Key problems; Physical Implications	Maxwell's equations in vaccum & Implications	Chapter 7 Griffiths
24	Maxwell's equations in matter; Constitutive relations; Interface conditions; Key problems; Physical Implications	Maxwell's equations in material media	Chapter 7 Griffiths
25	Low frequency and High frequency Circuits; General characteristics	AC Sources and AC circuits	Chapter 7 Griffiths
26	Wave equation as a consequence of Maxwell's equations; Monochromatic waves; Transverse nature of free space EM waves; Plane waves; Polarization, wave vector, wavelength; Intensity	Electromagnetic Wave Propagation in Vaccum	Chapter 9 Griffiths
27	Linear, Homogeneous, Isotropic & lossless dielectrics; Properties related to wave propagation	Electromagnetic Wave Propagation in Dielectrics	Chapter 9 Griffiths
28	Constitutive relations for a good conductor; Properties related to wave propagation	Electromagnetic Wave Propagation in Conductors	Chapter 9 Griffiths
29	**Pre-Comprehensive Review**		

General Information:

- **No makeup for Quizzes.**
- **The details of the project along with the evaluation scheme will be announced separately**
- **Not all topics will be covered in the tutorials. Students are expected to attend both lectures and tutorials**

Chamber Consultation Hours: To be announced in class

Notices: LMS

Instructor-in-charge