Lahore University of Management Sciences

EE330: Electromagnetic Fields and Waves

Spring 2016

Course Catalog Description
This course extends the concepts of static electric and magnetic fields to time-varying fields that give rise to electromagnetic waves. A brief overview of Vector Calculus, Electrostatics and Magnetostatics will be given in the beginning leading to Maxwell's equations and their mathematical formulation describing Electromagnetic wave phenomenon. Transmission lines are introduced as guiding structures for the propagation of electromagnetic waves. Propagation of electromagnetic waves through different types of media and their behavior at interfaces will be explored. Wave propagation in various applications such as waveguides and antennas will also be discussed.

Course Details	
Credit Hours	3
Core	Core Course for Electrical Engineering
Elective	
Open for Student Category	Junior / Senior
Closed for Student Category	Freshman / Sophomore

Course Prerequisite(s)/Co-Requisite(s)
MATH 102: Calculus-II (Required) PHY 204 Electricity and Magnetism (Required)

Course Offering Details						
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	75 min	Timings and Venue	WF: 3:30-4:45pm TBA
Recitation (per week)	Nbr of Rec (s) Per Week	X	Duration			
Lab (if any) per week	Nbr of Session(s) Per Week	x	Duration			
Tutorial (per week)	Nbr of Tut(s) Per Week	1	Duration	50		

Instructor	Imran Cheema
Room No.	9-349
Office Hours	Tuesday 12:00pm-1:00pm; Wednesday 12:00pm-1:00pm
Email	imran.cheema@lums.edu.pk
Telephone	042-35608467
Secretary/TA	TBA
TA Office Hours	TBA
Course URL (if any)	LMS

Lahore University of Management Sciences

Course Learning Outcomes	
	The students should be able to:
CLO 1	CLO 1: Analyze lossless and lossy transmission lines. Analyze wave reflections at discontinuities. Perform the transient analysis of transmission lines. Able to apply the learned concepts to simple transmission line problems.
CLO 2	CLO 2: Discriminate between basic integral and differential forms of the Maxwell's Equations for electrostatics and electrodynamics and solve Maxwell's equations for simple electromagnetic problems.
CLO 3	CLO 3: Analyze uniform plane wave propagation in free space, dielectrics, and good conductors along with understanding of wave polarization. Analyze uniform of plane wave reflection at normal and oblique incidence. Explore waveguides and antennas as applications of wave propagation in bounded and unbounded media, respectively. Able to apply the learned concepts to simple wave propagation problems.

Relation to EE Program Outcomes

EE-240 CLOs	Related PLOs	Levels of Learning	Teaching Methods	CLO Attainment checked in
CLO1	PLO2	Cog-3, Cog-4	Instruction, Tutorial, Quizzes Assignments	Midterm, Final
CLO2	PLO1	Cog-3, Cog-4	Instruction, Tutorial, Quizzes Assignments	Midterm, Final
CLO3	PLO2	Cog-3, Cog-4	Instruction, Tutorial, Quizzes Assignments	Final

Grading Breakup and Policy

Assignment(s): 10%
Quiz(s): 20%
Tutorials: 1 tutorials of 50 minutes
Midterm Examination: 30%
Final Examination: 40%

Week	Topics	Recommended Readings	Learning Objectives/
1.	Introduction, Motivation, Transmission lines Equations	**Chapter 1, Chapter 10 (Hayt), Chapter 7**	**CLO1 (2 Lectures)**
2.	Transmission lines Equations, loss less propagation, Transient analysis	**Chapter 10 (Hayt), Chapter 7**	**CLO1 (2 Lectures)**
3.	Sinusoidal waves on ideal Transmission lines, Non-Ideal Transmission lines	**Chapter 10 (Hayt), Chapter 7**	**CLO1 (2 Lectures)**
4.	Wave Reflection, VSWR, Finite Length Transmission lines, Vector Calculus Review	**Chapter 10 (Hayt), Chapter 7, Chapter 2**	**CLO1, CLO1 (2 Lectures)**
5.	Vector Calculus Review, Electrostatics Review	**Chapter 2, Chapter 3**	**CLO1 (2 Lectures)**
6.	Magnetostatics Review, Maxwell's Equations, Constitutive Relations	**Chapter 4, Chapter 5**	**CLO1 (2 Lectures)**
7.	Boundary conditions, Poynting Vector, Sinusoidal Steady State	**Chapter 5**	**CLO1 (2 Lectures)**
8.	Wave Equation, Uniform Plane Waves (UPW), UPW in Lossless and Lossy Media,	**Chapter 6**	**CLO3 (2 Lectures)**

Lahore University of Management Sciences

9.	UPW in Good Dielectrics & Conductors, Skin Depth, Wave Polarization	**Chapter 6**	**CLO3 (2 Lectures)**
10.	Normal Incidence of UPW (Coefficients and Fields), Normal Incidence of UPW (loss less/perfect conductors, multiple interfaces)	**Chapter 6**	**CLO3 (2 Lectures)**
11.	Oblique Incidence of UPW	**Chapter 6**	**CLO3 (2 Lectures)**
12.	RevisitingTransmission lines: Connecting with Maxwell's Equations, Waveguide Modes, Parallel Plate Waveguide	**Chapter 7, Chapter 8**	**CLO3 (2 Lectures)**
13.	Parallel Plate Waveguide, Rectangular Waveguides	**Chapter 8**	**CLO3 (2 Lectures)**
14.	Cavity Resonators, Introduction to Antennas	**Chapter 8**	**CLO3 (2 Lectures)**

Textbook(s)/Supplementary Readings
Text book: Introduction to Electromagnetic Fields (3rd Edition) by Clayton R. Paul, Keith W. Whites, Syed A. Nasar **Reference books:** Engineering Electromagnetics (8th Edition) by William H. Hayt and John A. Buck Introduction to Electrodynamics (3rd Edition) by David J. Griffiths

Examination Detail	
Midterm Exam	Yes/No: Yes Combine/Separate: Combine Duration: 2-3 hrs. **Date: 24 October 2016** Exam Specifications: Closed book, closed notes. A formula sheet will be provided.
Final Exam	Yes/No: Yes Combine/Separate: Combine Duration: 3 hrs. Exam Specifications: Closed book, closed notes. A formula sheet will be provided.