The University of Jordan
School of Engineering
Electrical Engineering Department
2nd Semester – A.Y. 2020/2021

Course:	**Electromagnetics – 0903253 (3 Cr. – Required Course)**
Instructor:	Dr. Yanal Al-Faouri Office: E306, Telephone: 06/5355000 ext 22857, Email: y.faouri@ju.edu.jo Office Hours: Will be posted soon
Course website:	http://elearning.ju.edu.jo/
Catalog description:	Introduction. Vectors and coordinate systems. Charges. Electric field. Potential and electric flux density. Gauss law. Electric characteristics of materials. Capacitors. Boundary conditions. Currents. Magnetic fields. Ampere's law. Magnetic properties of materials and the B-H curve. Boundary conditions. Inductors. Magnetic circuits. Time varying fields and Maxwell's equations. Waves in lossless and conducting media. Transmission lines (TL). Transient and steady state analysis of TL. Matching in TL. Introduction to optical fibers. Electromagnetic effects in high speed digital systems. Practical applications.
Prerequisites by course:	**Py** **0302102** General Physics II (pre-requisite)
Prerequisites by topic:	Students are assumed to have a background in the following topics: • Basic electricity and magnetism. • Calculus (differentiation, integration and vector calculus).
Textbook:	**Elements of Electromagnetics by Matthew Sadiku, Oxford University Press, 7th edition, 2018.**
References:	1. Fundamentals of Applied Electromagnetics by Fawwaz T. Ulaby and Umberto Ravaioli, Pearson, 7th Edition, 2014. 2. Advanced Engineering Electromagnetics by Constantine A. Balanis, 2nd edition, Wiley, 2012. 3. Field and Wave Electromagnetics by David K. Cheng, 2nd edition, Addison-Wesley, 1989. 4. Electromagnetic Fields by Roald K. Wangsness, 2nd edition, Wiley, 2007.

5. Electromagnetics by Branislav M. Notaros, Pearson, 1st Edition, 2010.
6. Schaum's Outline of Electromagnetics by Mahmood Nahvi and Joseph Edminister, McGraw-Hill Education, 5th Edition, 2018.
7. Schaum's Outline of Electromagnetics by Joseph Edminister, McGraw-Hill, 3rd Edition, 2010.
8. MATLAB-Based Electromagnetics by Branislav M. Notaros , 1st edition, Pearson, 2013.

Schedule: 16 Weeks, 42 lectures (50 minutes each) plus exams.

Course goals: The overall objective is to provide the student with the knowledge and proficiency to analyze electrostatic sources and the resulting electric fields, and magnetostatic sources and the resulting magnetic fields. In addition, the student is introduced to the concepts of electric and magnetic characteristics of materials, wave propagation, transmission lines and optical fiber.

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

Upon successful completion of this course, a student will:		[SO]
1.	Be able to utilize the different coordinate systems in solving physical problems.	[1]
2.	Identify the relationship between electrostatic sources and fields.	[1]
3.	Identify the relationship between magneto-static sources and fields.	[1]
4.	Understand the concept of magnetic circuits.	[1]
5.	Grasp the concepts of time varying fields and the implication of these concepts for practical applications.	[1]
6.	Be able to apply the wave equation and understand the electromagnetic wave propagation, and analyze the two conductor system transmission line.	[1]
7.	Understand the basic concepts of optical fiber and other modern electromagnetic systems.	[1]

Course topics:

		Hrs
1.	Vector Analysis: Vector operations, coordinate systems (cartesian, cylindrical and spherical), components, unit vectors, infinitismal length, area and volume, dot and cross products, conversion from one system to another.	6
2.	Electrostatic sources and fields: Point charge, line, surface and volume charge densities, potential and gradient. Electric flux density.	6
3.	Electric fields in material space and boundary value problems: Electric dipole, capacitors and boundary conditions.	5
4.	Magnetic sources and fields: Line current, linear and surface current densities. Magnetic force, torque, moment and the magnetic vector potential.	5
5.	Magnetic fields in material space and boundary value problems: Magnetic dipole, Magnetic Properties of materials, B-H curve. Boundary conditions, inductors and the magnetic circuits.	4
6.	Time varying fields. Maxwell's Equations (ME) in integral and differential forms. Boundary conditions.	4

7.	Wave equation and its solution for uniform plane wave (UPW) in lossless conducting media. Characterization of the UPW and identifying its different components such as its wavelength, wave number, direction of wave propagation, phase velocity, phase constant, attenuation constant, wave impedance, group velocity.	**4**
8.	Transmission line (TL) theory including the conversion from field components to voltage and current expressions. Derivation of the general TL equations in general form. TL propagation constant and its characteristic impedance.	**4**
9.	Transmission line charts and analysis. TL matching using single stub, double stub and quarter wavelength TL. Impedance measurements using Smith chart.	**2**
10.	Introduction to optical fiber and electromagnetic effects in high speed digital systems.	**2**

Ground rules: Attendance is required and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are not allowed during class, and cell phones must be set to silent mode. All exams (including the final exam) should be considered cumulative. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

Assessment & grading policy:

Assignments	0%	Quizzes	0%
First Exam	30%	Projects	0%
Midterm Exam	30%	Lab Reports	0%
Final Exam	40%	Presentation	0%
		Total	**100%**

Last Revised: March 2021