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

Course:	**Electromagnetics (I) – 0903251 (3 Cr. – Required Course)**
Instructor:	Dr. Yanal Al-Faouri Office: E314, Telephone: 06/5355000 ext 22843, Email: y.faouri@ju.edu.jo Office Hours: Will be posted soon
Course website:	https://elearning.ju.edu.jo/course/view.php?id=10181
Catalog description:	Introduction. Vectors and vector operations. Coordinate systems. Coulomb's law and electric field. Potential and gradient. Electric flux density. Gauss law and divergence theorem. Electric fields in material space. Capacitors. Boundary conditions, Poisson's and Laplace's equations. Method of images. Biot-Savart's law. Ampere's law. The curl and Stock's theorem. Magnetic force, torque and moment. Magnetic vector potential. Practical applications. Magnetic properties of materials. The B-H curve. Boundary conditions. Inductors. Magnetic circuits. Interaction between fields and charged particles. Faraday's law. Displacement current. Maxwell's equations. Continuity equation and the relaxation relationship. Time-harmonic fields and the hysteresis concept.
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. Engineering Electromagnetics by William H. Hayt, John A. Buck, McGraw-Hill Education, 8th edition 2011. 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. Engineering Electromagnetics by Nathan Ida, Springer; 3rd edition 2015.

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.

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 relations between electrostatic sources and fields.	**[1]**
3. Understand the gradient and divergence concepts and electrical polarization of materials.	**[1]**
4. Identify the relation between magneto-static sources and fields.	**[1]**
5. Understand the Curl concept, magnetic polarization of the magnetic materials and the concept of the magnetic circuits.	**[1]**
6. Characterize the interaction between charged particles and electric and magnetic fields.	**[1]**
7. Grasp the concepts of time varying fields and the implication of these concepts for practical applications.	**[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.	**8**
2. Electrostatic sources and fields: Point charge, line, surface and volume charge densities, Coulomb's law and electric field intensity, potential and gradient. Electric flux density, Gauss law and the divergence theorem.	**6**
3. Electric fields in material space and boundary value problems: Electric dipole, electric polarization, capacitors and boundary conditions. Poisson's and Laplace's equations. The method of images.	**8**
4. Magnetic sources and fields: Line current, linear and surface current densities, Biot-Savart's law, Ampere's law, the curl and Stock's theorem. Magnetic force, torque, moment and the magnetic vector potential.	**8**
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.	**8**

6.	Time varying fields: Faraday's law, displacement current and Maxwell's equations. Continuity equation and the relaxation relationship. Time-harmonic fields and the hysteresis concept, magnetic vector potential and retarded fields.	4

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