DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
COURSE SYLLABUS

EE 302: Electromagnetic Fields

COURSE TITLE	***CODE & NUMBER***	***SUBJECT AREA***	**Contact Hours**			**Credit Units**
			Th.	***Pr.***	***Tr.***	
Electromagnetic Fields	EE 302	Engineering	3	1	0	3
Pre-requisites:	EE 250, MATH 204					
Course Role in Curriculum *(Required/Elective):*	Required Course					
Catalogue Description: Develop an understanding of Maxwell's equations and have the capacity to apply them to solving practical electromagnetic problems. Fundamental concepts covered will include: Plane waves, Complex numbers and phasors, Transmission lines, Electrostatic fields, Poisson and Laplace equations, Steady Electric Current, Magnetostatic fields, Time-varying electric and magnetic fields.						

<u>Textbooks:</u>

1. Ulaby, F., Fundamentals of Applied Electromagnetics, Prentice-Hall, Seventh Edition, 2015 Global Edition

<u>Supplemental Materials:</u>

1. Slides, notes, and problem sets
2. David J. Griffiths, Introduction to Electrodynamics, Cambridge University Press, 2017
3. Liang C. Shen; Jin Au Kong, Applied Electromagnetism, Course Technology, 1995
4. Markus Zahn, Electromagnetic Field Theory, Krieger Publishing Company, 1987
5. Matthew N. O. Sadiku, Elements of Electromagnetics, Oxford University Press, 2018

<u>By the completion of the course the student should be able to:</u>

1. Solve for the major parameters and electromagnetic quantities involved in transmission line theory.
2. Apply vector calculus, differential and integral operators to electromagnetics.
3. Solve for electrostatic and scalar potential fields in vacuum and matter as well as compute capacitance.
4. Solve for magnetostatic and vector potential fields in vacuum and matter as well as compute inductance.
5. Analyze the coupling interaction among time-varying electric and magnetic fields and the resulting Maxwell equations.

<u>Topics to be Covered:</u>	***<u>Weeks:</u>***
1. Introduction: Electromagnetic spectra; Units and notation, discrete and field quantities; Traveling waves, Review of complex numbers, Review of Phasor transform.	2
2. Transmission Lines: General considerations; Lumped-Element Model; Transmission	2

Line Equations; Wave propagation on a Transmission Line; Lossless Transmission Line; Wave Impedance; Special Cases; Power Flow

3.	Vector calculus: Coordinate systems; Gradient of a scalar field; Divergence of a vector field, Divergence theorem; Curl of a vector field, Stokes's theorem; Laplacian operator; Graphing rational functions; Integration techniques	2
4.	Electrostatics: Maxwell's equations for static electric fields; Charge and current density. Continuity equation; Coulomb's law. Electric field. Electric flux density; Gauss's law; Electric potential; Conductors and resistance; Properties of dielectrics; Capacitors and capacitance; Electrostatic potential energy	3
5.	Magnetostatics: Magnetic flux density and magnetic field intensity; Magnetic forces; Magnetic Torque; Biot-Savart law; Ampere's law; Magnetic Vector Potential; Maxwell's equations for Magnetostatic fields; Gauss's law and Ampere's law; Inductance; Magnetic energy	3
6.	Time-varying fields: Dynamic fields; Faraday's law and the Electromotiveforce; Lenz's law; Ideal Transformer	2

Student Outcomes addressed by the course: (Put a ✓ sign)

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	✓
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
(3) An ability to communicate effectively with a range of audiences	
(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Instructor or course coordinator: Dr. Bandar Hakim

Last updated: Spring 2020