Course name	**ECE 31100 Electric and Magnetic Fields**
Credit and contact hours	(3 cr.) Class 3
Course coordinator's name	Maher Rizkalla
Textbook	W. H. Hayt, Jr., John A. Buck, *Engineering Electromagnetics*, 8^{th} Ed., McGraw-Hill, 2011. ISBN: 9780073380667.
Course information	ECE 31100 Electric and Magnetic Fields (3 cr.) P: MATH 26600 and PHYS 25100. Class 3. Continued study of vector calculus, electrostatics, and magnetostatics. Maxwell's equations, introduction to electromagnetic waves, transmission lines, and radiation from antennas. Students may not receive credit for both 311 and PHYS 330. **Prerequisites/ Co-Requisite** P: MATH 26600 and PHYS 25100 C:None **Required, Elective, or Selected Elective:** EE Required, CE Elective
Goals for the course	Upon successful completion of the course, students should be able to 1. Represent vector and point transformation between the three coordinates: Cartesian, cylindrical, and spherical. [1] 2. Calculate gradient, curl, divergence, and Laplacian for the three coordinates. [1] 3. Solve for the electric field intensity due to a charge distribution (point, line, surface, and volume distributed charges) using Coulomb's and Gauss' laws. [1] 4. Calculate the potential function from the electric field and describe the equipotential and stream line equations. [1] 5. Obtain the electrical energy density at a given field distribution. [1] 6. Use the method of images to obtain the electric field and induced charges on conductors. [1] 7. Solve Laplace's equation analytically in Cartesian, cylindrical and spherical coordinates. [1] 8. Use analogy between electric and magnetic field to get the magnetic field due to some current distribution considering coaxial cable, infinite sheet carrying surface current density, and filamentary wires. [1] 9. Obtain an expression for the magnetic energy density used in calculating the magnetic energy stored in a magnetic field. [1] 10. Use the analogy between electrical and magnetic circuits to solve for magnetic flux, magnetic potential, and reluctance. [1]

	11. Develop Maxwell's equations in dynamic and harmonic fields. [1,6] 12. Solve the plane wave equations for two and three layer structure. [1] 13. Use the concept of transmission and reflection coefficients to solve for the reflected and incident fields. [1] 14. Solve transmission line problems for the load voltage and current of matched and mismatched transmission lines. [1] 15. Use the Smith chart to solve for input impedance, reflection coefficient, transmission coefficient, location of stub matching, and to find unknown impedance terminating the transmission line. [1,2,6]
List of topics to be covered	1. Continued study of electrostatics and magneto statics, and electric boundary conditions (12 classes) 2. Solution of Laplace and Poisson's equations (3 classes) 3. Magnetic forces and magnetic boundary conditions (6 classes) 4. Time varying fields and Maxwell's equation (3 classes) 5. The uniform plane wave (3 classes) 6. Transmission lines (3 classes)
Syllabi approved by	Maher Rizkalla
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