**ELE3102 Electromagnetic Fields**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Period per  Week | | | Contact  Hour per  Semester | Weighted  Total Mark | Weighted  Exam Mark | Weighted  Continuous Assessment Mark | Credit  Units |
| LH | PH | TH | CH | WTM | WEM | WCM | CU |
| 45 | 30 | 00 | 60 | 100 | 60 | 40 | 4 |

**Rationale**

This course introduces students to the Basic laws electromagnetic fields and elementary applications of vector analysis, steady-state electric and magnetic fields, boundary value problems, and transmission lines.

**Objectives**

 To develop an understanding of electromagnetic-field fundamentals by emphasizing both mathematical analytical rigor and physical conceptual reasoning, as applied toward practical engineering problems.

 To develop the ability to analyze engineering systems based on electrostatic fields, steady electric currents, and magneto static fields in arbitrary material media,

 To apply vector calculus to solutions of a variety of static field problems

 To develop a solid grasp and an appreciation of Maxwell’s equations and use these equations to solve time-varying field problems.

**Course Content**

***1. Electromagnetic Potentials and Topics for Circuits and System***

 Poisson’s and Laplace equations

 Capacitance, conductance and inductance

 Magnetic circuits

***2. Transmission-Lines Essentials***

 Transmission lines

 Lines terminated by reactive and non-linear resistive elements

***3. Transmission Lines for Communications***

 Different matching configurations

 Smith Chart

 Lossy Lines

***4. Guided Wave Principles for Electronics and Optoelectronics***

 Wave propagation in any direction

 TE and TM waves in parallel plate waveguide

 Dispersion and group velocity

 Reflection and refraction

 Dielectric waveguide

***5. Waveguides and Antennas Fundamentals***

 Rectangular Waveguides

 Transverse Electromagnetic Waves (TEM)

 Transverse Magnetic (TM) Modes

 Transverse Electric (TE) Modes

 Wave Propagation in the Guide

 Power Transmission and Attenuation

 Waveguide Current and Mode Excitation

 Waveguide Resonators

**Learning Outcomes**

By the end of this course, students should be able to:

 Demonstrate a firm understanding of electromagnetic fields

 Solve realistic electromagnetic-field problems utilizing physical conceptual reasoning and mathematical synthesis of solutions, and not pure formulaic solving.

**Recommended and Reference Books**

*[1]* K. Lonngren, S. Savov, & R. Jost, *Fundamentals of Electromagnetics with*

*MATLAB,* 2nd Edition (Scitech Publishing, 2007).

*[2]* R. Wolfson & J. Pasachoff, *Physics for Scientists and Engineers* (Addison- Wesley).

*[3]* J. Stewart, *Calculus*, Third Edition (Brooks/Cole Publishing Company, 1995).

*[4]* N. N. Rao, “*Elements of Engineering Electromagnetics*,” 6th Edition, Prentice

Hall, 2004.

*[5] Field and Waves in Communication Electronics,* third edition, Ramo, Whinnery, and Van Duzer, Wiley, 1994

*[6]* William H. Hayt, Jr. John A. Buck, 2000. *Engineering Electromagnetics*. 6th

Edition MC Graw Hill.

*[7]* Mathew N.O. Sadiku, 2006*. Elements of Electromagnetics*, 4th Edition. ISBN

13: 9780195300482, ISBN 10:0195300483