# ELECTROMAGNETICS AND TRANSMISSION LINES – ESE319
## SYLLABUS

## ABET COURSE OUTCOMES:

Fundamental aspects of electromagnetic wave propagation and radiation, with application to the design of high speed digital circuits and communication systems. Topics include: solutions of Maxwell's equations for characterization of EM wave propagation in unbounded and lossy media; radiation of EM energy; guided wave propagation with emphasis on transmission line theory.

## PRE-REQUISITES REQUIREMENTS: - ESE271

Students should have a good understanding of complex algebra, vector calculus and, basic circuit analysis techniques.

Goal for this course

The goal is to establish a fundamental understanding of electromagnetic wave propagation and its role in the design of high speed electronic circuits and communication systems.

Objectives that are related to this Goal

1. Transmission line fundamentals
2. Application to high speed digital circuits and communication systems
3. Electromagnetic wave propagation in lossy media
4. Radiation fundamentals

| Week 1 | Introduction, EM spectrum,  complex numbers RLC circuits, speed of signal transmission |
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| Week 2 | Current flow in conductors, space and time Transmission lines, Telegrapher's equations |
| Week 3 | Terminations, reflection coefficient, Smith Chart |
| Week 4 | Lossy and dispersive TL. Vectors and co-ordinate systems |
| Week 5 | Electrostatics – Coulomb, Gauss's |
| Week 6 | Dielectric materials, capacitance, Magnetic fields, Ampere's law |
| Week 7 | Magnetic forces,  inductance,  Boundary conditions and Laplace Equation |
| Week 8 | Time varying fields |
| Week 9 | Maxwell's equations, time harmonic EM wave |
| Week 10 | EM wave propagation  - plane wave solution , polarization |
| Week 11 | EM wave propagation in lossy medium, Reflection and transmission |
| Week 12 | Radiation fields:  Short  dipole antenna – antenna characteristics, Radiation power and resistance |
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| Exams | Test 1; Test 2;  Final: |

## COURSE TEXTBOOK:

Fundamentals of Applied Electromagnetics (7th ed), Fawwaz T. Ulaby,

B001ITRPCS

| **PROGRAM OUTCOMES AND ASSESSMENT** | **% contribution*** |
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On the following "3 a-k" list, please check those topics which are covered within the course:

⌐ (a) ability to  apply knowledge of math, engineering, and science — 75

⌐ (b1) ability to design and conduct experiments

⌐ (b2) ability to analyze and interpret data — 5

⌐ (c) ability to design system, component or process to meet needs

⌐ (d) ability to function on multi-disciplinary teams

⌐ (e) ability to identify, formulate, and solve engineering problems — 10

⌐ (f) understanding of professional and ethical responsibility

⌐ (g) ability to communicate effectively — 5

⌐ (h) broad education

⌐ (i)  recognition of need an ability to engage in life-long learning

⌐ (j)  knowledge of contemporary issues

⌐ (k) ability to use techniques, skills, and tools in engineering practice — 5

⌐ Any other outcomes and assessments?