Module Specification

Electromagnetic Fields and Waves

Version: 2027-28, v1.0, Approved

Contents

Part 1: Information

Module title: Electromagnetic Fields and Waves

Module code: UFMEAW-15-3

Level: Level 6

For implementation from: 2027-28

UWE credit rating: 15

ECTS credit rating: 7.5

College: College of Arts, Technology and Environment

School: CATE School of Engineering

Partner institutions: None

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: Mathematics for Electrical Engineers 2025-26

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: The concepts and theory of electromagnetic fields are addressed initially in this module to establish the foundation for electromagnetic applications in electrical engineering. Topics include non-Cartesian vectors, Coulomb's law, Biot-Savart law, Gauss's law, and Maxwell's equations. The theory and practice of signal transmission lines (T-lines) and electromagnetic waves are addressed along with electrical engineering applications. The Smith Chart is utilised to graphically display

and interpret T-line and measurement results. Electromagnetic interference and signal integrity concepts are introduced.

Features: Not applicable

Educational aims: This module aims to develop the students understanding in electromagnetic fields and waves.
This module introduces the different laws governing electric and magnetic fields and electromagnetic waves. This culminates in the understanding of design for signal integrity and rf interference.

Outline syllabus: Vector Analysis
Static Electric Fields, Coulomb's Law
Static Magnetic Fields, Biot-Savart Law
Time-varying Fields, Maxwell's Equations
Plane Electromagnetic Waves, Polarization
Transmission Lines
Waveguides, Cavity Resonators
Antennas and Radiating Systems
Signal Integrity and Radio Frequency Interference

Part 3: Teaching and learning methods

Teaching and learning methods: The deliver of this module is intended to ensure that students not only learn the theory of electromagnetic fields and waves but also their application to the design of electric circuits that ensure signal integrity and are resistant to radio frequency interference. This is done by a combination of theoretical exercises and practical tutorials.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Demonstrate a thorough understanding of the theory of electromagnetic fields and waves.

MO2 Apply the theory of electromagnetic fields and waves to the design of circuits that provide signal integrity and are immune to rf interference.

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 36 hours

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/4DDE1EB7-3628-51E6-09CE-B143375E9D1B.html?lang=en-GB&login=1

Part 4: Assessment

Assessment strategy: The assessment strategy recognises the fact that the theory of electromagnetic fields and waves is mathematically challenging, and a thorough understanding is necessary to apply theory to practice. Therefore, it uses a portfolio approach of different theoretical and practical challenges of increasing complexity and scope.

The resit strategy is the same as the first sit strategy.

Assessment tasks:

Portfolio (First Sit)
Description: Portfolio (A number of milestones totalling 30 pages including designs and simulation results)
Weighting: 100 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2

Portfolio (Resit)
Description: Portfolio (A number of milestones totalling 30 pages including designs and simulation results)

Weighting: 100 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Electrical and Electronic Engineering [Frenchay] BEng (Hons) 2025-26

Electrical and Electronic Engineering {Foundation} [Frenchay] BEng (Hons) 2024-25