

EE5439: META-DEVICE AND PHOTONIC SYSTEM ANALYSIS

Effective Term

Semester B 2024/25

Part I Course Overview

Course Title

Meta-device and Photonic System Analysis

Subject Code

EE - Electrical Engineering

Course Number

5439

Academic Unit

Electrical Engineering (EE)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

P5, P6 - Postgraduate Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

The aim of the course is to provide students with theoretical knowledge, simulation modeling and analytical skills necessary for an in-depth understanding of photonic system of optoelectronics and meta-devices. Major topics include antenna design, the interaction between electromagnetic waves and matter, and property analysis for nanostructures, meta-devices and photonic systems.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Explain the principles of electromagnetic waves and Fundamental concepts of meta-devices and photonic systems.		x	x	
2	Apply photonic system analysis techniques to meta-devices and photonic systems.		x	x	
3	Design and analyse meta-devices and photonic systems for specific functions and visualization of simulated results.		x	x	x
4	Perform independent studies to identify the potential applications and innovations of meta-devices and advanced photonic systems.		x	x	x

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

LTAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture and Tutorial	Knowledge of the general concepts in photonic systems and their applications; practice simulation modeling and analysis.	1, 2, 3, 4	3 hrs/wk for 13 weeks

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Test (> 2 times)	1, 2, 3, 4	26	
2	Assignments (> 3 times)	1, 2, 3, 4	12	Includes homework, tutorial exercises, and in-class exercises.

3	Reports/Project	2, 3, 4	12	Includes reports, project, mini-project, and presentation.
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Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Remark: To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

Assessment Rubrics (AR)

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal level

Assessment Task

Coursework (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal level

Assessment Task

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B) Medium

Marginal

(B-, C+, C) Low

Failure

(F) Not even reaching marginal level

Assessment Task

Coursework (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B) Medium

Marginal

(B-, C+, C) Low

Failure

(F) Not even reaching marginal level

Additional Information for AR

Constructive Alignment with Programme Outcomes

PILO 1,2,3,4 - Students are required to apply the fundamental theoretical knowledge and analytical skills for an in-depth understanding of meta-devices and photonic systems. The students will formulate and solve problems using the learnt knowledge and skills.

PILO 2,3,4,5 - Students are required to complete an independent research study on new developments of meta-devices and photonic systems.

PILO 6 - Students are required to give an oral presentation of their independent projects.

Part III Other Information

Keyword Syllabus

- Fundamental concepts of photonics
- Basic principle of meta-devices
- Overview of photonic systems
- Design, fabrication, characterization and application of meta-devices
- General meta-device and photonic system analysis techniques
- Simulation modelling, parameters setting, and result verification
- Visualization and analysis of simulated results
- Case study: simulation of meta-devices and photonic systems

Reading List

Compulsory Readings

Title	
1	Course notes provided by the instructor

Additional Readings

Title	
1	Roger W. Pryor, Multiphysics Modeling Using COMSOL 5 and MATLAB, 2022
2	Layla S. Mayboudi, Geometry Creation and Import With COMSOL Multiphysics (Multiphysics Modeling Series), 2019.
3	Slawomir Sujecki, Photonics Modeling and Design, 2014
4	Sophocles Orfanidis, Electromagnetic Waves and Antennas, 2016.
5	Merhzad Tabatabaian, COMSOL5 for Engineers, 2015.
6	Levent Sevgi, Electromagnetic Modeling and Simulation, 2014.