Subject Description Form

Subject Code	EIE571
Subject Title	Photonic System Analysis
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	N/A
Objectives	1. Understand the principles and techniques of photonic device and system analysis, simulation and modeling 2. Learn to obtain optical characteristics of photonic devices and systems through computer simulation.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: <u>Category A: Professional/academic knowledge and skills</u> a. Understand how to analyze and design photonic devices and systems through modeling and simulation. b. Learn to use simulation methods to build up the database for the design of photonic devices and systems. <u>Category B: Attributes for all-roundedness</u> c. Communicate effectively. d. Think critically and creatively. e. Assimilate new technological development in the related field.
Subject Synopsis/ Indicative Syllabus	**1. Fundamental concepts** 1-1. Basic concepts of optics 1-2. Polarization 1-3. Size versus light wavelength 1-4. Common photonic system analysis techniques **2. Photonic simulation** 2-1. Simulation parameters 2-2. Create 2D/3D model of photonic simulation 2-3. Material import for photonic simulation 2-4. Boundary conditions **3. Meshing techniques** 3-1. Mesh types 3-2. Boundary layer meshing 3-3. Automatic re-meshing **4. Simulation solver and result verification** 4-1. Visualization of simulated results 4-2. Analysis of simulation data **5. Case study: simulation of photonic device**

Teaching/Learning Methodology

Analysis, simulation and modeling of photonic devices and systems will be described and demonstrated in this subject. Students will be guided through laboratory exercises related to the materials taught in each session. The laboratory exercises should be finished during the class. Students will be given the opportunity to study some design examples in the field and share their findings with other classmates through presentations and reports. Students are requested to design a mini project of photonic devices by using the photonic simulation method.

Teaching/Learning Methodology	Intended Subject Learning Outcomes				
	a	b	c	d	e
Lectures	✓	✓		✓	✓
Laboratory exercises	✓	✓		✓	✓
Case study/report	✓	✓	✓	✓	✓
Mini project	✓	✓	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Assignments	20%	✓	✓		✓	✓
2. Laboratory exercises	40%	✓	✓		✓	✓
3. Mini project	10%	✓	✓	✓	✓	✓
4. Tests	30%	✓	✓			
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assignments: Students will need to review the taught materials and some of the photonics simulation design examples, give a presentation, and write a report. Students can learn more in-depth and understand the current developments of photonics simulation.

Laboratory exercises: For each session, students will need to complete the lab exercises and write a report. Through the lab exercises, students can practice and be proficient in the operating of photonic simulation.

Mini project: Students have to design a photonic device project by photonic simulation, give a presentation, and write a report.

Tests: Students will need to answer questions about the fundamentals and technologies of photonic system analysis.

Student Study Effort Expected

Class contact:	
▪ Lectures/Tutorial	26Hrs.
▪ Laboratory exercises	13Hrs.
Other student study effort:	

	▪ Assignments and mini project	66 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. Layla S. Mayboudi, Geometry Creation and Import With COMSOL Multiphysics (Multiphysics Modeling Series), 2019. 2. Slawomir Sujecki, *Photonics Modelling and Design*, 2014. 3. Merhzad Tabatabaian, *COMSOL5 for Engineers,* 2015. 4. Sophocles Orfanidis, *Electromagnetic Waves and Antennas*, 2016. 5. Levent Sevgi, *Electromagnetic Modeling and Simulation*, 2014.	

July 2023