City University of Hong Kong
Course Syllabus

offered by Department of Electrical Engineering
with effect from Semester A 2022/2023

Part I Course Overview

Course Title:	Optical Fibres and Waveguides
Course Code:	EE6429
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

The aim of the course is to provide students with fundamental theoretical knowledge and analytical skills necessary for an in-depth understanding of the modern optical fibre and waveguide technology, as well as an opportunity to discover new knowledge in the subject area by carrying out independent research studies on advanced topics of current interest.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Analyze the modal and transmission characteristics of optical fibres.		✓	✓	
2.	Analyze the modal characteristics of planar waveguides and describe common waveguide fabrication and measurement techniques.		✓	✓	
3.	Analyze the characteristics of some common fibre and waveguide devices.		✓	✓	✓
4.	Perform independent studies on new developments and applications related to the optical fibre and waveguide technology.		✓	✓	✓
		100%			

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 self-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.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lectures	Teaching students important concepts, theories, methodologies, and practices in the subject	✓	✓	✓				2 hrs/wk
Tutorials	Engaging students in problem solving and discussions to consolidate what they learn in the lectures	✓	✓	✓				1hr/wk
Take-home/in-class assignments	More challenging problems set as assignments to help students develop the ability/skill to think critically and discover	✓	✓	✓				
Individual research study on new developments in the subject	Individual studies on topics of current interest to help students develop the ability/skill to learn independently and discover				✓			

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4				
Continuous Assessment: 50%								
Test	✓	✓	✓				15%	
Assignments	✓	✓	✓				10%	
Essay on an individually assigned research topic				✓			15%	
Oral presentation on the assigned research topic				✓			10%	
Examination: 50% (duration: 2hrs , if applicable)								
							100%	

Remark:

To pass the course, students are required to achieve at least 30% in course work and 30% in the examination and complete the individual research study.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B,)	Marginal (B-, C+, C)	Failure (F)
1. Examination	Achievements in CILOs	High	Medium	Low	Not even reaching marginal level
2. Coursework	Achievements in CILOs	High	Medium	Low	Not even reaching marginal level

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal level
2. Coursework	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal level

6. Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1, 2, 3, 4	The course provides students with the fundamental theoretical knowledge and analytical skills necessary for an in-depth understanding of the modern optical fibre and waveguide technology, which underlines the advancement of optical communications, optical signal processing, and optical sensing. The students have many opportunities to formulate and solve problems within the subject area by applying the learnt knowledge and skills.
2, 5	The course provides an opportunity for each student to discover new knowledge by carrying out an independent research study on an advanced topic of current interest.
6	The students can practise their communication skills through essay writing and power-point presentation of their results on the research studies.

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

Electromagnetic Theory of Guided Waves
Wave equations
Concept of modes

Optical Fibres
Multimode fibres
Single-mode fibres
Special fibres (birefringent fibres, photonic crystal fibres, multicore fibres, few-mode fibres, etc.)
Transmission characteristics of fibres

Planar Optical Waveguides
Slab waveguides
WKB analysis of graded-index waveguides
Rectangular-core waveguides
Marcatili's method
Effective-index method
Fabrication and characterization of waveguides

Coupled-Mode Theory
Coupled-mode equations
Application to parallel waveguides
Application to periodic structures

Selected Topics on Fibre and Waveguide Devices and Applications
Passive devices (couplers, WDM multiplexers, mode multiplexers, gratings, ring resonators, etc.)
Active devices (electro-optic modulators, optical amplifiers, etc.)
Applications (dispersion compensation, advanced multiplexing schemes, optical sensors, optical interconnect, etc.)

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Nil

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	M J Adams: An introduction to Optical Waveguides, (John Wiley, 1981)
2.	A W Snyder and J D Love: Optical Waveguide Theory, (Chapman and Hall, 1983)
3.	T Tamir (Ed.): Integrated Optics, (2nd Edition, Springer-Verlag, 1985)
4.	H Nishihara, M Haruna, and T Suhara: Optical Integrated Circuits, (McGraw-Hill, 1985)
5.	D L Lee : Electromagnetic Principles of Integrated Optics, (John Wiley, 1986)
6.	D Marcuse: Theory of Dielectric Optical Waveguides, (2nd Edition, Academic Press, 1991)
7.	R Syms and J Cozens: Optical Guided Waves and Devices, (McGraw-Hill, 1992)
8.	A Ghatak and K Thyagarajan: Introduction to Fiber Optics, (Cambridge University Press, 1998)
9.	K S Chiang: Integrated Optic Waveguides in Encyclopedia of Electrical and Electronics Engineering, J. G. Webster (Ed.) (John Wiley, 1999), Vol. 10, pp. 400-418; updated online version 2007.
10.	Professional journals, such as Journal of Lightwave Technology, IEEE Photonics Technology Letters, Optics Letters, Optics Express, Electronics Letters, etc.