

國立中正大學課程大綱

National Chung Cheng University Syllabus

課號 Course Code	2708058	全英文授課 EMI	<input checked="" type="checkbox"/> 是 <input type="checkbox"/> 否
課程類別 Course Type	<input type="checkbox"/> 人文關懷課程 <input type="checkbox"/> 競賽專題課程 <input checked="" type="checkbox"/> 問題導向課程(Problem-based course) <input type="checkbox"/> 專題導向課程 <input type="checkbox"/> 總整課程 <input type="checkbox"/> 實作課程 <input type="checkbox"/> 其他		
課程名稱 (中文)	光電物理 (全英文授課)		
課程名稱 (英文) Course	Electo-Optics (Teach in English)		
學年 Academic Year /Semester	114 學年度第 2 學期 Spring semester, 2026	學分 Credits	3
學系 (所) Department	物理所 (Physics)	必選修 Compulsory/Elective	<input type="checkbox"/> 必修 Compulsory <input checked="" type="checkbox"/> 選修 Elective
上課時間 Class Hours	Tuesday (F、G)	上課地點 Classroom	Physics R303
教師 Instructor	段必輝 (Pi-Hui Tuan)	教師 Email Instructor' s Email	phtuan@ccu.edu.tw
助教 Teaching Assistant		助教 Email TA' s Email	
先修科目或 先備能力 Prerequisites	1. 電磁學 Electromagnetism 2. 光學 Optics		
課程概述 Course Descriptions	1. 光的波動性與 Maxwell 方程式回顧 Review of the wave natures of light and Maxwell equations 2. 光波傳遞：時間與空間域的干涉 Optical wave propagation: interference in temporal and spatial domain 3. 介面反射、折射、光波導與導引模 Interfacial reflection and refraction for optical waveguides and guided modes 4. 雷射基本原理：激發源、增益介質、共振腔 Basic principles of lasers：pump sources, gain media, and optical resonators 5. 雷射光的空間與時間調製 Temporal and spatial modulation of laser fields 6. 半導體物理及光電元件基礎 Fundamentals of semiconductor physics and optoelectronic devices 7. 偏振光學 Polarization optics 8. 非線性光學 Nonlinear optics 本課程旨在介紹一般從事光電領域相關研究時常用的半導體光電元件及裝置之基礎原理，期待藉由數值模擬分析及學期專題實務演練培養學生學用合一的科學素養。		

	The main goal of this course is to introduce the fundamental principles of the semiconductor-based optoelectronic devices used in the research of photonics. Students who take this course are expected to cultivate practical skills combined with the theoretical principles to solve realistic issues by the designed assignments of numerical simulation and the semester project presentation.
學習目標 Learning Objectives	簡介半導體光電元件物理及應用，作為後續進階光子學物理研究領域之基礎。 Briefly address the fundamental physics of semiconductor-based optoelectronic devices and their applications to set core concepts for further exploring advanced photonic physics.
教科書及參考書 Textbooks And References	S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, 1st ed. (Pearson). Hermann A. Haus, Waves and Fields in Optoelectronics (Prentice-Hall). Bahaa E. A. Saleh, Malvin Carl Teich, Fundamentals of Photonics (John Wiley & Sons).

教學要點概述	
教材編選 Teaching Materials	<input checked="" type="checkbox"/> 自製簡報(ppt) (PowerPoints Slides) <input checked="" type="checkbox"/> 課程講義 (Lecture handouts) <input type="checkbox"/> 自編教科書 <input type="checkbox"/> 教學程式 <input type="checkbox"/> 自製教學影片 <input type="checkbox"/> 其他
教學方法 Teaching Method	<input checked="" type="checkbox"/> 講述(投影片、板書) (Instruction) <input type="checkbox"/> 小組討論 <input checked="" type="checkbox"/> 學生口頭報告 (Oral presentation) <input checked="" type="checkbox"/> 問題導向學習 (Problem-based learning) <input type="checkbox"/> 個案研究 <input type="checkbox"/> 其他
評量工具 Evaluation	<input checked="" type="checkbox"/> 期中考 30% (Midterm) <input type="checkbox"/> 期末考 <input type="checkbox"/> 隨堂測驗 <input type="checkbox"/> 隨堂作業 <input checked="" type="checkbox"/> 課後作業 20% (Assignments) <input type="checkbox"/> 期中報告 <input checked="" type="checkbox"/> 期末報告 25% (Final oral presentation) <input type="checkbox"/> 專題報告 <input type="checkbox"/> 評量尺規 <input checked="" type="checkbox"/> 其他 (others): 專案演示(project demonstration) 25%
教學資源 Teaching Resources	<input type="checkbox"/> 課程網站 <input checked="" type="checkbox"/> 教材電子檔供下載 (Downloadable e-files for teaching materials) <input type="checkbox"/> 實習網站
與 SDGs 目標的關聯 Related to Objectives Of SDGs	<input type="checkbox"/> SDG 1 終結貧窮 <input type="checkbox"/> SDG 2 消除飢餓 <input type="checkbox"/> SDG 3 健康與福祉 <input checked="" type="checkbox"/> SDG 4 優質教育 (Quality education) <input type="checkbox"/> SDG 5 性別平權 <input type="checkbox"/> SDG 6 淨水及衛生 <input checked="" type="checkbox"/> SDG 7 可負擔的潔淨能源 (Affordable and Clean Energy) <input checked="" type="checkbox"/> SDG 8 合適的工作及經濟成長 (Decent Work and Economic Growth) <input checked="" type="checkbox"/> SDG 9 工業化、創新及基礎建設 (Industry, Innovation and Infrastructure) <input type="checkbox"/> SDG 10 減少不平等

	<div><input type="checkbox"/>SDG 11 永續城鄉</div> <div><input type="checkbox"/>SDG 12 責任消費及生產</div> <div><input type="checkbox"/>SDG 13 氣候行動</div> <div><input type="checkbox"/>SDG 14 保育海洋生態</div> <div><input type="checkbox"/>SDG 15 保育陸域生態</div> <div><input type="checkbox"/>SDG 16 和平、正義及健全制度</div> <div><input type="checkbox"/>SDG 17 多元夥伴關係</div> <div><input type="checkbox"/>無關聯</div>																									
教師 相關訊息 Instructor's Information	段必輝 (Pi-Hui Tuan), Office: Room 409 of department of physics Extension number: 66322																									
每週課程內容 Weekly Scheduled Contents																										
Week 1 (02/20) 課程簡介&常見光電元件 Course introduction & commonly-used optoelectronic components																										
Week 2 (02/27) Maxwell 方程式及光的波動性 Review of Maxwell's equations and the wave nature of light																										
Week 3 (03/05)光波傳遞-時與空間域的干涉 Wave propagation- interference in temporal and spatial domain																										
Week 4 (03/12)介面反射、折射與多層膜分析 Interfacial reflection & refraction; Analysis of multi-layer coatings																										
Week 5 (03/19)光波導與導引模 Optical waveguides and guided modes																										
Week 6 (03/26)雷射三要素 Three elements for lasers																										
Week 7 (04/02)雷射實務分析與實作 Practical analyses of lasers and demonstration																										
Week 8 (04/09)校際活動週停課 The week for intercollegiate activities (classes suspended)																										
Week 9 (04/16)期中考 Midterm exam																										
Week 10 (04/23)雷射光的空間與時間調製 Temporal and spatial modulation of laser fields																										
Week 11 (04/30)半導體物理基礎 Fundamentals of semiconductor physics																										
Week 12 (05/07)光電元件基礎 Fundamentals of optoelectronic devices																										
Week 13 (05/14)半導體發光、感測元件實務應用 Practical applications for semiconductor-based light emitting and detecting devices																										
Week 14 (05/21)偏振光學 Polarization optics																										
Week 15 (05/28)非線性光學 Nonlinear optics																										
Week 16 (06/04)期末專案實作討論(1) Alignment and discussion for final project demonstration (1)																										
Week 17 (06/11)期末專案實作討論(2) Alignment and discussion for final project demonstration (2)																										
Week 18 (06/18)期末專案發表、演示 Final project presentation and demonstration																										
核心能力 Core Competencies																										
<table><tr><th colspan="2" rowspan="2">核心能力 Core Competency</th><th colspan="5">本課程與核心能力關聯強度 Degrees of related to core competencies</th></tr><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><td rowspan="2">專業能力 Specific Competency</td><td>專業能力 1：具備物理領域之專業知識 Knowing the modern features of fluid dynamics</td><td></td><td></td><td></td><td>○</td><td></td></tr><tr><td>專業能力 2：具備策劃及執行物理及相關領域</td><td></td><td></td><td></td><td>○</td><td></td></tr></table>		核心能力 Core Competency		本課程與核心能力關聯強度 Degrees of related to core competencies					1	2	3	4	5	專業能力 Specific Competency	專業能力 1：具備物理領域之專業知識 Knowing the modern features of fluid dynamics				○		專業能力 2：具備策劃及執行物理及相關領域				○	
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	專題研究之能力 Incubating student capabilities for reading literatures					
	專業能力 3：具備撰寫物理專業論文之能力 Bridging lecture content to modern research topics		○			
	專業能力 4：具備邏輯推理及獨立思考解決相關問題之能力 Practicing the presentation skill				○	
	專業能力 5：具備終身自我學習成長之能力 Practicing the capability for finding answer from discussion				○	

半導體光電元件物理基礎、口頭報告、程式模擬能力

Basic concepts of semiconductor-based optoelectronic devices, oral presentation, and numerical simulation.