專業必修/選修課程綱要表

課程名稱：（中文）**高等固態物理** （英文）**Advanced Solid-State Physics**				開課單位	能源電池科技博士班
				課程代碼	
授課教師：盧榮宏					
學分數	3	必/選修	選修	開課年級	
先修科目或先備能力：普物、材料物理性質(或近代物理)、工程數學					
課程概述與目標：固態物理是半導體科學與光電科學的核心學理。本課程的目標在於(一)能以理論分析晶體鍵結、晶體震動模式、晶體電子能帶的形成、介電材料與鐵電材料、超導材料與磁材料;(二)能深度瞭解奈米複層結構、奈米複合結構、奈米多孔結構對機械性質的影響;(三)能深度瞭解奈米結構對熱性質的影響、奈米結構對材料電子能帶特性的影響、半導體各式接面的光電特性、以及電漿與電漿子科技;(四)能深度瞭解奈米結構對介電材料與鐵電材料的影響、奈米結構對超導材料與磁材料的影響;(五)能創造高價值化的能源、光電、奈米、生醫、材料應用。					
教科書 [1]	固態物理-講義				

課程綱要		對應之學生核心能力	核心能力達成指標
單元主題	內容綱要		
Crystal Binding, Nano-structure, and Mechanical Properties	探討晶體鍵結, 以及奈米複層結構、奈米複合結構、奈米多孔結構的機械性質。	1,2,3,4,5,6,7	1.能以理論分析晶體鍵結。2.深度瞭解奈米複層結構、奈米複合結構、奈米多孔結構對機械性質的影響。
Phonons and Thermal Properties	探討晶體震動模式, 以及奈米結構材的熱性質。	1,2,3,4,5,6,7	1.能以理論分析晶體震動模式。2.深度瞭解奈米結構對熱性質的影響。
Electron Energy Bands	晶體電子能帶的形成, 以及探討奈米結構材料的電子能帶性質。	1,2,3,4,5,6,7	1.能以理論分析晶體電子能帶的形成。2.深度瞭解奈米結構對材料電子能帶特性的影響。
Semiconductors and Junctions	探討半導體各式接面的光電特性, 以及能源應用的問題。	1,2,3,4,5,6,7	1.深度瞭解半導體各式接面的光電特性。2.高價值化的能源應用。
Plasma and Plasmons	探討電漿與電漿子性質,以及在光電、奈米、生醫的檢測與製程應用。	1,2,3,4,5,6,7	1.深度瞭解電漿與電漿子科技。2.能以理論分析光電、奈米、生醫的檢測應用。3. 廣度瞭解光電、奈米、生醫的製程應用。
Modern Optics and Thin Film Optics	探討近代光學與薄膜光學設計, 以及在奈米、能源的應用。	1,2,3,4,5,6,7	1.深度瞭解近代光學與薄膜光學科技。2.廣度瞭解近代光學與薄膜光學在奈米、能源的應用。
Dielectrics and Ferroelectrics	探討介電材料與鐵電材料的特性與應用。	1,2,3,4,5,6,7	1.能以理論分析介電材料與鐵電材料。2.深度瞭解奈米結構對介電材料與鐵電材料的影響。3.高價值化的介電材料與鐵電材料應用。

Superconductivity and Magnetic properties	探討超導材料與磁材料的特性與應用。	1,2,3,4,5,6,7	1.能以理論分析超導材料與磁材料。2.深度瞭解奈米結構對超導材料與磁材料的影響。3.高價值化的超導材料與磁材料應用。

教學要點概述[2]：

參考教材：

(1) Charles Kittle, Introduction to Solid State Physics, 8th ed., John Wiley & Sons, Inc., 2005.

(2) C. Dupas, P. Houdy, and M. Lahmani, Nanoscience: Nanotechnologies and Nanophysics, Springer, 2007.

(3) Rainer Waser, Nanoelectronics and Information Technology: Advenced Electronic Materials and Novel Devices, Wiley-VCH, 2003.

(4) Paras N. Prasad, Nanophotonics, John Wiley & Sons, Inc., 2004.

評量方法：

(1)期中考試: 30%

(2)書面及口頭報告: 30%

(3)期末考試: 40%

教學相關配合事項：

可透過網路大學學習平台取得課程輔助教材及授課相關資料。

註：1. 教科書請註明書名、作者、出版社、出版年等資訊。

2. 教學要點概述請填寫教材編選、教學方法、評量方法、教學資源、教學相關配合事項等。

3. 學程所有開設之課程皆須填寫此表格或提供原有格式之課程綱要表，並呈現於實地訪評現場。

COURSE SYLLABUS

Course Title：
Advanced Solid-State Physics

Credits / Hours	3/3	Course Number		□Required ■Elective

Course Description

Course overview and objectives: Solid-state physics is the theoretical core of semiconductor science and optoelectronic science. The objectives of this course: (1) Able to theoretically analyze crystal bonding, crystal vibration mode, electronic energy band, dielectric and ferroelectric materials, superconducting materials and magnetic materials. (2) Deeply to understand the mechanical properties with nano-multi-layer structure, nano-composite structure, nano-porous structure. (3) Deeply to understand the thermal properties of nanostructures, the electronic band structure of nano-materials, the characteristics of semiconductor junctions, as well as plasma and plasmons. (4) To gain insight into the impact of nano-structure for dielectric materials and ferroelectric materials, as well as for magnetic materials and superconducting materials. (5) To create high value applications for energy, optoelectronics, nanotechnology, biomedical and materials.

Course Topics

Topic	Content
Crystal Binding, Nano-structure, and Mechanical Properties	(1) Theoretically analyze the crystal bonding. (2) Deeply to understand the mechanical properties with nano-multi-layer structure, nano-composite structure, nano-porous structure.
Phonons and Thermal Properties	(1) Theoretically analyze the crystal vibration mode. (2) Deeply to understand the thermal properties of nanostructures.
Electron Energy Bands	(1) Theoretically analyze the electronic energy band. (2) Deeply to understand the electronic band structure of nano-materials.
Semiconductors and Junctions	(1) Deeply to understand the characteristics of semiconductor junctions. (2) To create high value applications for energy and optoelectronics.
Plasma and Plasmons	(1) Deeply to understand the plasma and plasmons. (2) To create high value applications for biomedical and materials.
Modern Optics and Thin Film Optics	(1) Deeply to understand the modern optics and thin film optics. (2) Widely to understand the applications for energy and nanotechnology.
Dielectrics and Ferroelectrics	(1) Able to theoretically analyze the dielectric and ferroelectric materials. (2) To gain insight into the impact of nano-structure for the dielectric materials and ferroelectric materials.
Superconductivity and Magnetic properties	(1) Able to theoretically analyze the superconducting materials and magnetic materials. (2) To gain insight into the impact of nano-structure for the magnetic materials and superconducting materials.