

教學大綱(Syllabus)-大學部

系務會議通過修訂日期：2007/9/12
updated:2007/10/04

課程編碼 (course no.)	U044			學分 (credits)	3	
課程名稱 (course name)	(中) 固態物理導論					
	(Eng.) Introduction to Solid State Physics					
開課系所班級 (dept. & year)	材料科學與工程學系大學部四年級 (Dept. of Mat. Sci. & Engr., Senior)			授課教師 (teacher)	歐陽浩 教授 (Prof. Hao Ouyang)	
課程類別 (course type)	選修 (Elective)	授課語言 (language)	中文 (Chinese)	開課學期 (semester)	上學期 (Fall)	
課程簡述 (course description)	(中) 使學生了解固體許多性質與材料結構關係的由來，如鍵結能、電阻等。					
	(Eng.) Helping student to understand the relation between solid properties and microstructures, like bonding energy, resistivity etc.					
課程目標 (course objectives)	(中) 1. 簡介及晶體結構 2. 倒晶格與繞射 3. 晶體鍵結 4. 聲子與熱性質 5. 自由電子模型 6. 能帶理論					
	(Eng.) 1. Introduction and crystal structures 2. Reciprocal lattice and diffraction 3. Crystal binding 4. Phonons and thermal properties 5. Free electron Fermi gas 1. Band theory (introduction)					
先修課程(prerequisites)						
課程編碼 (course no.)	課程名稱 (course name)			與課程銜接的重要概念、原理與技能 (relation to the current course)		
教學模式 (teaching methodology)	模式 (methodology)	講授 (teaching)	討論/報告 (discussion & report)	實驗/參訪 (exp./fab visit)	遠距/網路教學 (remote/web teaching)	合計 (sum)

學分分配 (credit distrib.)	2	1			3
授課時數分配 (hour distrib.)	2	1			3



授課進度與內容 (週次、單元名稱與內容、習作/考試進度、備註) (course content and homework/tests schedule)			
週次 (week)	單元名稱與內容 (subject and content)	習作/考試進度 (homework and tests)	備註 (remark)
01	Overall Introduction		
02	Crystal Structure		
03	Reciprocal Lattice – diffraction and scattering	Homework#1	
04	Reciprocal Lattice – B.Z and Fourier analysis of the basis		
05	Reciprocal Lattice – Quasicrystal and other applications(Low D scattering)		
06	Crystal Binding: inert gases & ionic crystals		
07	Crystal Binding: metals & hydrogen bonds		
08	Crystal Binding: atomic radii & brief introduction of elasticity		
09		Midterm	
10	Phonons: introduction & vibrations of X'tal s with monatomic basis		
11	Phonons: vibrations of X'tal s with 2 atoms per primitive basis	Homework#2	
12	Phonons: quantization of elastic waves; phonon momentum		
13	Phonons: inelastic scattering by phonons		
14	Phonons: phonon heat capacity		
15	Phonons: anharmonic crystal interactions		
16	Phonons: thermal conductivity & introduction of electrons		
17		Final presentation	
18		Final presentation	
學習評量方式 (evaluation)			
(1) Homework assignment: 5% (2) Midterm presentation: 45% (3) Final presentation and report: 50%			
作業 (Homework): 作業共 2 次, 目的在評估學生對課堂講授內容的了解程度, 並且培養同學平日課後複習的習慣以及思考問題的能力。題目將出現在期中考中。			

期中考 (Midterm):

目的在評估學生對課堂講授內容及作業的了解程度。

期末報告 (Final presentation):

每位同學從文獻的回顧及專題結果中，針對固態物理與材料科學關係，從期刊蒐集相關的論文，以固態物理思考方式重新檢驗材料科學，於學期末提出報告。目的是要培養學生蒐集資料、整理資料與分析資料的能力，並訓練學生表達與溝通的能力。

期末書面報告 (Term paper):

將期末報告內容整理成書面報告，目的是要培養學生撰寫報告的能力

教科書 (書名、作者、書局、代理商、說明)

(textbook)

參考書目 (書名、作者、書局、代理商、說明)

(other references)

1. "Introduction to Solid State Physics", 7th edition, by Charles Kittel(John Wiley & Sons, Inc. New York), 1996: introduction level
2. "Solid State Physics" by N.W. Ashcroft & N.D. Mermin(Saunders Colledge Publishing, Ford Worth), 1976: intermediate level

代理商均為歐亞書局

課程教材 (教師個人網址請列在本校內之網址。)

(teaching aids & teacher's website)

**與學系教育目標之關聯性(材料系)****(relation to educational objective of materials engineering department)**

1. 提供材料性質、製程與應用及跨領域知識與訓練
To provide interdisciplinary know-how and training on materials properties, processing, and applications
2. 培育具獨立思考、創新與實作能力之材料科技人才
To train materials technology students for independent thinking, innovation, and practical skills
3. 培養團隊合作精神與溝通協調整合能力
To cultivate the spirit of teamwork and the capacity of integrated cooperation
4. 建立多元價值與國際觀
To inculcate multifarious values and cosmopolitan worldview
5. 強化綠色材料科技教育
To implement educational programs in eco-materials technology

與學系教育核心能力之關聯性(材料系)**(relation to educational core abilities for materials engineering department)**

- (A) 運用數學、科學及材料工程知識能力
Ability to apply knowledge of mathematics, science, and materials engineering
- (B) 設計與執行材料實驗及分析數據之能力
Ability to design and conduct experiments, as well as analyze data
- (C) 執行材料工程實務所需之技術與能力
Ability to use techniques and skills for materials engineering practices
- (D) 製程整合及元件實作之能力
Ability to integrate process and make devices
- (E) 溝通協調之能力與團隊合作之精神
Ability to communicate effectively and cultivate the spirit of teamwork
- (F) 獨立思考及解決問題之能力
Ability to think independently and solve problems
- (G) 培養國際觀及認識綠色材料對全球環境的影響
Cultivation of cosmopolitan worldview and understanding effects of eco-materials on global environment
- (H) 終身學習之習慣與能力
Ability to cultivate life-long learning habit
- (I) 瞭解材料工程人員的社會責任與專業倫理
Understanding materials engineers' social responsibility and professional ethics

課程內涵達成學系【教育目標】比對資料

授課進度與內容	教育目標				
	目標一 提供材料性質、製程與應用及跨領域知識與訓練	目標二 培育具獨立思考、創新與實作能力之材料科技人才	目標三 培養團隊合作精神與溝通協調整合能力	目標四 建立多元價值與國際觀	目標五 強調綠色材料科技教育
請勾選關聯性 <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Overall Introduction	1	1	0	0	1
Crystal Structure	1	1	0	0	0
Reciprocal Lattice – diffraction and scattering	1	1	0	0	0
Reciprocal Lattice – B.Z and Fourier analysis of the basis	1	1	0	0	0
Reciprocal Lattice – Quasicrystal and other applications(Low D scattering)	1	1	0	0	0
Crystal Binding: inert gases & ionic crystals	1	1	0	0	0
Crystal Binding: metals & hydrogen bonds	1	1	0	0	0
Crystal Binding: atomic radii & brief introduction of elasticity	1	1	0	0	0
Phonons: introduction & vibrations of X'tal s with monatomic basis	1	1	0	0	0
Phonons: vibrations of X'tal s with 2 atoms per primitive basis	1	1	0	0	0
Phonons: quantization of elastic waves; phonon momentum	1	1	0	0	0
Phonons: inelastic scattering by phonons	1	1	0	0	0
Phonons: phonon heat capacity	1	1	0	0	0
Phonons: anharmonic crystal interactions	1	1	0	0	0
Phonons: thermal conductivity & introduction of electrons	1	1	0	0	0
Phonons: introduction & vibrations of X'tal s with monatomic basis	1	1	0	0	0
Final presentation	1	1	1	0	0
Final presentation	1	1	1	0	0
總計(%)	100%	100%	11%	0%	5%

- 註：
1. 所有必修課均須填寫此表。
 2. 矩陣中請填入關聯性； 1 表示相關，0 表示無相關。
 3. 學系教育目標項次請依據表1填寫。



課程內涵達成學系【核心能力】比對資料(大學部)

授課進度與內容	核心能力								
	A	B	C	D	E	F	G	H	I
	運用數學、科學及材料工程知識能力	設計與執行材料實驗及分析數據之能力	執行材料工程實務所需之技術與能力	製程整合及元件製作之能力	溝通協調之能力與團隊合作之精神	獨立思考及解決問題之能力	培養國際觀及認識綠色材料對全球環境的影響	終身學習之習慣與能力	瞭解材料工程人員的社會責任與專業倫理
請勾選關聯性 <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Overall Introduction	1	1	1	0	0	1	1	0	0
Crystal Structure	1	1	1	0	0	1	0	0	0
Reciprocal Lattice – diffraction and scattering	1	1	1	0	0	1	0	0	0
Reciprocal Lattice – B.Z and Fourier analysis of the basis	1	1	1	0	0	1	0	0	0
Reciprocal Lattice – Quasicrystal and other applications(Low D scattering)	1	1	1	0	0	1	0	0	0
Crystal Binding: inert gases & ionic crystals	1	1	1	0	0	1	0	0	0
Crystal Binding: metals & hydrogen bonds	1	1	1	0	0	1	0	0	0
Crystal Binding: atomic radii & brief introduction of elasticity	1	1	1	0	0	1	0	0	0
Phonons: introduction & vibrations of X'tal s with monatomic basis	1	1	1	0	0	1	0	0	0
Phonons: vibrations of X'tal s with 2 atoms per primitive basis	1	1	1	0	0	1	0	0	0
Phonons: quantization of elastic waves; phonon momentum	1	1	1	0	0	1	0	0	0
Phonons: inelastic scattering by phonons	1	1	1	0	0	1	0	0	0
Phonons: phonon heat capacity	1	1	1	0	0	1	0	0	0
Phonons: anharmonic crystal interactions	1	1	1	0	0	1	0	0	0
Phonons: thermal conductivity & introduction of electrons	1	1	1	0	0	1	0	0	0
Phonons: introduction & vibrations of X'tal s with monatomic basis	1	1	1	0	0	1	0	0	0
Final presentation	1	1	1	0	1	1	0	1	0
Final presentation	1	1	1	0	1	1	0	1	0
總計(%)	100%	100%	100%	0%	11%	100%	5%	11%	0%

- 註：
1. 所有必修課均須填寫此表。
 2. 矩陣中請填入關聯性； 1 表示相關，0 表示無相關。
 3. 學系教育目標項次請依據表1填寫。