教學大綱(Syllabus)-大學部

課程編碼 (course no.)	U020			學分 (credits)	3
課程名稱 (course name)	(中)　　固態擴散				
	(Eng.)　Diffusion in Solids				
開課系所班級 (dept. & year)	材料工程學系大學部三年級(Junior)			授課教師 (teacher)	呂福興 教授 (Prof. Fu-Hsing Lu)
課程類別 (course type)	選修 (Elective)	授課語言 (language)	中文 (Chinese)	開課學期 (semester)	下學期
課程簡述 (course description)	(中) 主要在介紹固態擴散之基本觀念與應用等，並以微觀之原子理論與巨觀之現象理論，二方面之觀點加以探討，以使學生對固態擴散有較深入之瞭解·				
	(Eng.) To introduce the basic concepts and applications of diffusion in solids. Two approaches including the microscopic atomic theory and the macroscopic phenomenological theory are employed to explore the subject.				
課程目標 (course objectives)	(中) 1. 瞭解固態擴散之基本理論: 微觀之原子理論與巨觀之現象理論 2. 瞭解固態擴散之應用				
	(Eng.) 1. Understand basic theories of diffusion in solids: microscopic atomic theory and macroscopic phenomenological theory 2. Understand applications of diffusion in solids				

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.)	3				3
	授課時數分配 (hour distrib.)	3				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	Syllabus & Introduction: Definition, applications		
02	Introduction: Diffusion Coefficients, etc.		
03	Diffusion Equations: Fick's Laws		
04	Diffusion Equations: Solutions to Diffusion Equations (I)		
05	Diffusion Equations: Solutions to Diffusion Equations (II)		
06	Atomic Theory of Diffusion: Diffusion Mechanisms		
07	no class		
08	Atomic Theory of Diffusion: Random-Walk Theory		
09	Prelim	Prelim	
10	Atomic Theory of Diffusion: Correlation Effects (I)		
11	Atomic Theory of Diffusion: Correlation Effects (II)		
12	Phenomenological Approach: Interdiffusion		
13	Phenomenological Approach: Uphill Diffusion		
14	Phenomenological Approach: Fluxes and Driving Forces (I)		
15	Phenomenological Approach: Fluxes and Driving Forces (II)		
16	Point Defects and Diffusion (I)		
17	Point Defects and Diffusion (II)/ High Diffusivity Path		
18	Final exam	Final exam	

學習評量方式
(evaluation)

平時、小考或作業成績等 (quiz, homework, or others) (30%)，

期中考 (prelim) (30%)，

期末考 (final exam) (40%)

教科書（書名、作者、書局、代理商、說明）
(textbook)

自編講義 (class notes)

參考書目（書名、作者、書局、代理商、說明
(other references)

1. Paul Shewmon, *Diffusion in Solids*, 2nd Ed., The Minerals, Metals, and Materials Society, (1989).

2. M.E. Glicksman, *Diffusion in Solid*s, John Wiley & Sons, New York, (2000).

3. J. Crank, *The Mathematics of Diffusion*, 2nd Ed., Oxford University Press, London, (1975)

課程教材（教師個人網址請列在本校內之網址。）
(teaching aids & teacher's website)

http://web.nchu.edu.tw/~fhlu

學習評量方式
(evaluation)

平時、小考或作業成績等 (quiz, homework, or others) (30%)，

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

註： 1. 所有必修課均須填寫此表。

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☑	☑	☑	☐	☑	☑
Syllabus & Introduction	1	0		1	1
Introduction	1	0		1	1
Diffusion Equations: Fick's Laws	1	1		1	0
Diffusion Equations: Solutions to Diffusion Equations (I)	1	1		0	0
Diffusion Equations: Solutions to Diffusion Equations (II)	1	1		0	0
Diffusion Equations: Solutions to Diffusion Equations (III)	1	1		0	0
Atomic Theory of Diffusion: Diffusion Mechanisms	1	0		0	0
Atomic Theory of Diffusion: Random-Walk Theory	1	0		0	0
Atomic Theory of Diffusion: Correlation Effects (I)	1	0		0	0
Atomic Theory of Diffusion: Correlation Effects (II)	1	0		0	0
Phenomenological Approach: Interdiffusion	1	0		0	0
Phenomenological Approach: Uphill Diffusion	1	0		0	0
Phenomenological Approach: Fluxes and Driving Forces (I)	1	0		0	0
Phenomenological Approach: Fluxes and Driving Forces (II)	1	0		0	0
Point Defects and Diffusion (I)	1	0		0	0
Point Defects and Diffusion (II)	1	0		0	0
High Diffusivity Path	1	0		0	0
總計(%)	100	24		18	12

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	製程整合及及元件實作之能力	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☑	☑	☑	☑	☐	☐	☑	☑	☑	☑
Syllabus & Introduction	1	0	0			1	1	1	1
Introduction	1	0	0			1	1	1	1
Diffusion Equations: Fick's Laws	1	1	0			1	0	1	0
Diffusion Equations: Solutions to Diffusion Equations (I)	1	1	0			1	0	1	0
Diffusion Equations: Solutions to Diffusion Equations (II)	1	1	1			1	0	1	0
Diffusion Equations: Solutions to Diffusion Equations (III)	1	1	1			1	0	0	0
Atomic Theory of Diffusion: Diffusion Mechanisms	1	0	0			1	0	0	0
Atomic Theory of Diffusion: Random-Walk Theory	1	0	0			1	0	0	0
Atomic Theory of Diffusion: Correlation Effects (I)	1	0	0			1	0	0	0
Atomic Theory of Diffusion: Correlation Effects (II)	1	0	0			1	0	0	0
Phenomenological Approach: Interdiffusion	1	0	0			1	0	0	0
Phenomenological Approach: Uphill Diffusion	1	0	0			1	0	0	0
Phenomenological Approach: Fluxes and Driving Forces (I)	1	0	0			1	0	0	0
Phenomenological Approach: Fluxes and Driving Forces (II)	1	0	0			1	0	0	0
Point Defects and Diffusion (I)	1	0	0			1	0	0	0
Point Defects and Diffusion (II)	1	0	0			1	0	0	0
High Diffusivity Path	1	0	0			1	0	0	0
總計(%)	100	24	18			100	12	29	12

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。