國立中興大學教學大綱(Syllabus)-大學部

課程名稱 (course name)	（中）材料熱力學(上) (U002)				
	(Eng.) Thermodynamics in Materials Science (1/2)				
開課系所班級 (dept. & year)	材料系大學部	學分 (credits)	3	授課教師 (teacher)	張立信
課程類別 (course type)	■必修(Mandatory) □選修(Elective)	授課語言 (language)	中文	開課學期 (semester)	上學期
課程簡述 (course description)	（中）本學期的課程由介紹熱力學的基本原理與函數開始。先簡介第一、第二與第三熱力學定律的緣起以及內容，並定義三狀態函數，分別是內能、焓與熵。接著介紹輔助函數---自由能的概念，由此獲得物質系統平衡之準則，並應用係數關係與馬士威爾關係推導熱力學函數間之關係，以及教導焓、熵與自由能等函數變化量之計算。接下來則教授溶體行為，包括混合函數、分量、活性定義與溶體模型，如氣體之凡德瓦方程與規則溶液模型。最後則教導相平衡與一、二元相圖之觀念。				
	(Eng.) The course in the first semester begins with the fundamental principles and functions of thermodynamics. The origins and contents of 1st, 2nd and 3rd laws in which three defined state functions, the internal energy, enthalpy and entropy, are lectured. The auxiliary functions---free energies are the next topic and the relations between thermodynamic variables are introduced from the coefficient relations and Maxwell's relations. The calculations of enthalpy, entropy and free energy change of system are taught sequentially. Then, the behaviors of solutions are shown including the functions of mixing, partial quantity, definition of activity and solution models, e.g. the van der Waals equation and the regular solution model. Finally, the concepts of phase equilibria, unary and binary phase diagrams are taught.				
先修課程名稱 (prerequisites)					

課程目標與核心能力關聯配比(%) (relevance of course objectives and core learning outcomes)			教學方法與評量方法 (teaching and assessment methods)	
課程目標(中/ Eng.)	核心能力	配比	教學方法	評量方法
1. 能了解並應用第一定律計算能量交換 (To understand and apply the 1st Law in calculation of energy exchange) 2. 能了解並應用第二定律判斷過程之不可逆性 (To understand and apply the 2nd Law in justification of process irreversibility)	■1.運用數學、科學及材料工程知識能力	50%	講授	測驗
3. 能了解第三定律並牢記波茲曼方程 (To understand the 3rd Law and remember the Boltzmann's equation)	■2.設計與執行材料實驗及分析數據之能力	30%		
4. 能了解狀態函數定義原則與其物理涵義 (To understand the definitions and physical meanings of state functions)	■3.執行材料工程實務所需之技術與能力	10%		
5. 能熟練運用數學方法，推導函數之關係與與計算 (To derive relations and calculate functions with	□4.製程整合及元件實作之能力			

mathematic methods skillfully) 6. 能了解並應用混合函數與活性概念於多元系統 (To understand and apply functions of mixing and concept of activity in multicomponent systems) 7. 能了解並應用模型描述溶體行為，含凡德瓦方程與規則溶體 (To understand and apply models in description of solution behaviors, incl. van der Waals equation and regular solution) 8. 能了解平衡準則與相平衡概念 (To understand the equilibrium criteria and concept of phase equilibrium) 9. 能了解與判讀一元相圖並牢記 Clayperon 方程 (To understand the read the unary phase diagram and remember the Clayperon equation) 10. 能了解與判讀二元相圖 (To understand the read the binary phase diagram)	□5.溝通協調之能力與團隊合作之精神 ■6.獨立思考、解決問題、終身學習之習慣與能力 □7.培養國際觀及認識綠色材料對全球環境的影響 □8.瞭解材料工程人員的社會責任與專業倫理	10%

授課內容(單元名稱與內容、習作/考試進度、備註)
(course content and homework/ tests schedule)

01	第一定律	The 1st Law	
02	第二定律	The 2nd Law	
03	第三定律	The 3rd Law	
04	函數定義	Functions Definitions	測驗 1
05	函數關係	Functions Relations	
06	函數關係	Functions Relations	
07	焓與熵	Enthaply & Entropy	測驗 2
08	熵與自由能	Entropy & Free Energy	
09	期中考	Midterm	
10	氣體行為	Behavior of Gases	
11	混合物函數	Functions of Mixing	
12	溶體行為	Behavior of Solutions	
13	平衡準則	Equilibrium Criteria	測驗 3
14	相平衡	Phase Equilibria	
15	一元相圖	Unary Phase Equilibria	
16	二元相圖	Binary Phase Equilibria	測驗 4
17	二元相圖	Binary Phase Equilibria	
18	期末考	Final Exam	

學習評量方式
(evaluation)

1. 學期成績計算項目及權重標準如下：
   (The percentages of items concerned :)
   A. 期中考(Midterm exam)　30%
   B. 期末考(Final exam)　　30%
   C. 測驗(Tests)　　　　　40%
2. 期考(Examinations)
   期中、期末考均配合學校考試時程。內容包含所有講授與教科書中內容。
   (The midterm and final exam are carried out according to the semester schedule. The content taught in the course is the target of the exams.)

3. 測驗(Tests)

課程每一單元結束後，將規定課後練習題要求學生完成。課程內容進行到一定份量，將進行測驗，定期評量學生學習表現。本學期安排四次，期中考前後各兩次。

(Some exercises of each chapter are assigned as the homework after finishing the chapter. Tests are carried out as certain contents are lectured for evaluating the academic performance of students. Four tests are arranged in this semester, twice before and after the midterm.)

教科書&參考書目（書名、作者、書局、代理商、說明）
(textbook& other references)

教科書 Textbook
書名(Title)：Chemical Thermodynamics for Metals and Materials, 2006
作者(Author)：Hae-Geon Lee
出版社(Publisher)：Imperial College Press
代理商(Agent)：無、中興大學電子書(None, e-book in Netlibrary in NCHU)
說明(Description)：本書是針對材料相關科系之大專生所寫。作者以化學的觀點講授古典熱力學的原理以及應用於材料科學上所需具備的知識。本書章節以重點敘述的方式安排，可強化學習效果。選擇本書作為教科書的另一原因是本書較為精簡的內容，可使學生較快具備熱力學概念，預期將較能接受同時進行的物理冶金課程。

(This book is written for students in material-related departments. The author lectures the principles of classic thermodynamics and the knowledge of their applications on materials science in the chemical aspect. The sections of this book are arranged by the way of key statements which can enhance the effect of learning. Another reason of choosing this book as the textbook is its simplified content which enables students to possess thermodynamic concept more quickly and to comprehend anticipatively the course of physical metallurgy that is hold spontaneously.)

參考書目(References)
1. D.R. Gaskell, "Introduction to the Thermodynamics of Materials", 4th ed., Taylor & Francis, NY, 2003 (偉明圖書、Wei-Ming bookstore)
說明(Description)：本教科書是材料熱力學書籍中最常被台灣學界所指定之教科書，再版次數相當多，亦是授課教授求學時之教科書。本書之內容與編排已經過數十年之更新，難度與廣度皆頗適宜大學部學生研讀。
(Among all books concerning thermodynamics, this book is mostly designated as textbook for lessens of thermodynamics in materials in Taiwan. This book has been re-edited for many tomes and is well written for undergraduates.)

2. R.T. DeHoff, "Thermodynamics in Materials Science", McGraw-Hill, Singapore, 1993 (民全書局、Ming-Chiang bookstore)
說明(Description)：本書在熱力學關係之推演上頗有獨到之處，值得學習。
(Good supplement to the textbook for some unique interpretations.)

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

請進入中興大學圖書館網頁 http://www.lib.nchu.edu.tw/查詢、線上閱讀或下載教科書之電子書
(Please enter the webpage of NCHU library to survey, read on-line or download the e-book of textbook)

課 程 輔 導 時 間 (office hours)	學期間每週二下午 04:00-05:00 (04:00-05:00 pm Tuesday in semester)