教學大綱(Syllabus)-研究所

系務會議通過修訂日期：2007/9/12

updated: 2007/10/10

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| **課程編碼(course no.)** | | D16 | | | | | | | **學分**  **(credits)** | | | ３ | | | |
| **課程名稱**  **(course name)** | | (中)　電子顯微鏡特論 | | | | | | | | | | | | | |
| (Eng.)　Special topics on transmission electron microscopy | | | | | | | | | | | | | |
| **開課系所班級**  **(dept. & year)** | | 材料科學與工程學系博士班一年級  (Dept. of Mat. Sci. & Engr.,Doctor) | | | | | | **授課教師**  **(teacher)** | | | | | 杜正恭 教授  (Prof. Jenq-Gong Duh) | | | |
| **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  (Spring) | | | |
| **課程簡述**  **(course description)** | | (中) 深入探討電子顯微鏡及其分析能力 | | | | | | | | | | | | | |
| (Eng.) An in-depth look at electron microscopy and its analytical capabilities | | | | | | | | | | | | | |
| **課程目標**  **(course objectives)** | | (中)   1. 繞射和X-ray粉末繞射 2. TEM光學結構 3. 散射、非彈性散射和光譜 4. 晶體繞射、電子繞射和晶體學 5. TEM影像的繞射對比，繞射線形 6. Patterson 函數和漫散射 7. 高解析TEM影像 8. 動力理論 | | | | | | | | | | | | | |
| (Eng.)  1. Diffraction and the X-ray powder diffractometer.  2. The TEM and its optics.  3. Scattering, inelastic electron scattering and spectroscopy.  4. Diffraction from crystals, electron diffraction and crystallography.  5. Diffraction contrast in TEM images and diffraction lineshapes.  6. Patterson functions and diffuse scattering.  7. High-resolution TEM imaging.  8. Dynamic theory. | | | | | | | | | | | | | |
| **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) | | | | | | | | | | |
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| **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 | Overall Introduction | | | | | | | | |  | | | |  | | |
| 02 | Diffraction and the X-ray powder diffractometer | | | | | | | | |  | | | |  | | |
| 03 | The TEM and its optics | | | | | | | | |  | | | |  | | |
| 04 | Scattering | | | | | | | | |  | | | |  | | |
| 05 | Inelastic electron scattering and spectroscopy | | | | | | | | |  | | | |  | | |
| 06 | Diffraction from crystals | | | | | | | | |  | | | |  | | |
| 07 | Electron diffraction and crystallography | | | | | | | | | Homework # 1 | | | |  | | |
| 08 | Electron diffraction and crystallography | | | | | | | | |  | | | |  | | |
| 09 | Midterm Examination | | | | | | | | |  | | | |  | | |
| 10 | Diffraction contrast in TEM images | | | | | | | | |  | | | |  | | |
| 11 | Diffraction lineshapes | | | | | | | | |  | | | |  | | |
| 12 | Patterson functions and diffuse scattering | | | | | | | | |  | | | |  | | |
| 13 | Patterson functions and diffuse scattering | | | | | | | | |  | | | |  | | |
| 14 | High-resolution TEM imaging | | | | | | | | |  | | | |  | | |
| 15 | High-resolution TEM imaging | | | | | | | | | Homework # 2 | | | |  | | |
| 16 | Dynamic theory | | | | | | | | |  | | | |  | | |
| 17 | Dynamic theory | | | | | | | | |  | | | |  | | |
| 18 | Final Examination | | | | | | | | |  | | | |  | | |
| **學習評量方式**  **(evaluation)** | | | | | | | | | | | | | | | | |
| 1. Homework assignment: 20% 2. Midterm Examination 40% 3. Final Examination 40%   作業（Homework）：  作業共2次，目的在評估學生對課堂講授資料的了解程度，並且培養同學平日課後複習的習慣以及思考問題的能力。  期中與期末考試（Midterm and Final Examination）：  期中與期末考試測驗各一次，目的在於評估學生對於課程授課的了解程度。 | | | | | | | | | | | | | | | | |
| **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. “Transmission Electron Microscopy and Diffractometry of Materials ”2nd ed. by B. Fultz & J. M. Howe(Springer –Verlag Berlin Heidelberg , 2002, 偉明圖書有限公司代理) 2. “Transmission Electron Microscopy” by David B. Williams and C. Barry Carter(Plenum,1996 ) | | | | | | | | | | | | | | | | |
| **課程教材（教師個人網址請列在本校內之網址。）**  **(teaching aids & teacher's website)** | | | | | | | | | | | | | | | | |
| 1、Power point files. | | | | | | | | | | | | | | | | |

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| **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) 特定材料之專業知識  Specialized knowledge in Materials science and Engineering  (B) 策劃及執行專題研究之能力  Ability to plan and execute a research project  (C) 撰寫專業論文之能力  Ability to write journal articles  (D) 創新思考及獨立解決問題之能力  Ability to do innovative thinking and independent problem solving  (E) 跨領域協調整合之能力  Ability to work in an interdisciplinary setting  (F) 國際觀及綠色材料意識  A fine international scope and general concept of eco-material  (G) 領導、管理及規劃之能力  Ability in leadership, management, and organization  (H) 終身自我學習成長之能力  Ability for life-long learning  (I) 學術專業倫理  Professional ethics in Science and Engineering |

**課程內涵達成學系【教育目標】比對資料**

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| **授課進度與內容** | 教育目標 | | | | |
| 目標一 | 目標二 | 目標三 | 目標四 | 目標五 |
| 提供材料性質、製程與應用及跨領域知識與訓練 | 培育具獨立思考、創新與實作能力之材料科技人才 | 培養團隊合作精神與溝通協調整合能力 | 建立多元價值與國際觀 | 強化綠色材料科技教育 |
| **請勾選關聯性🗹** | **🗹** | **🗹** | **🗹** | **🗹** | **🗹** |
| Overall Introduction | 1 | 1 | 1 | 1 | 1 |
| Diffraction and the X-ray powder diffractometer | 1 | 1 | 1 | 1 | 1 |
| The TEM and its optics | 1 | 1 | 1 | 1 | 1 |
| Scattering | 1 | 1 | 1 | 1 | 1 |
| Inelastic electron scattering and spectroscopy | 1 | 1 | 1 | 1 | 1 |
| Diffraction from crystals | 1 | 1 | 1 | 1 | 1 |
| Electron diffraction and crystallography | 1 | 1 | 1 | 1 | 1 |
| Diffraction contrast in TEM images | 1 | 1 | 1 | 1 | 1 |
| Diffraction lineshapes | 1 | 1 | 1 | 1 | 1 |
| Patterson functions and diffuse scattering | 1 | 1 | 1 | 1 | 1 |
| High-resolution TEM imaging | 1 | 1 | 1 | 1 | 1 |
| Dynamic theory | 1 | 1 | 1 | 1 | 1 |
| 總計(%) | 100(%) | 100(%) | 100(%) | 100(%) | 100(%) |

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(研究所)**

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| **授課進度與內容** | 核心能力 | | | | | | | | |
| A | B | C | D | E | F | G | H | I |
| 特定材料之專業知識 | 策劃及執行專題研究之能力 | 撰寫專業論文之能力 | 創新思考及獨立解決問題之能力 | 跨領域協調整合之能力 | 國際觀及綠色材料意識 | 領導、管理及規劃之能力 | 終身自我學習成長之能力 | 學術專業倫理 |
| **請勾選關聯性🗹** | **🗹** | **🗹** | **🗹** | **🗹** | **🗹** | **🗹** | **🗹** | **🗹** | **🗹** |
| Overall Introduction | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Diffraction and the X-ray powder diffractometer | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| The TEM and its optics | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Scattering | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Inelastic electron scattering and spectroscopy | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Diffraction from crystals | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Electron diffraction and crystallography | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Diffraction contrast in TEM images | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Diffraction lineshapes | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Patterson functions and diffuse scattering | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| High-resolution TEM imaging | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Dynamic theory | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 總計(%) | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

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。