專業必修/選修課程綱要表

課程名稱：（中文）**高等儀器分析**				開課單位	化工所
（英文）**Advanced Instrumental Analysis**				課程代碼	
授課教師：簡文鎮					
學分數	3	必/選修	選修	開課年級	碩化一
先修科目或先備能力：普化、有機化學、儀器分析、儀器分析實驗、基礎英文閱讀					
課程概述與目標：本課程使用英文教科書用以增進學生英文閱讀能力，且應用到相關儀器分析設備所發表之研究文獻或報告為教材。本課程主要在講授實驗室一些常見及貴重之分析儀器的作用原理、儀器構造、定性及定量方式及相關應用技術。學生修畢本課程後，應可對常見之層析分析、光學光譜分析及熱分析儀器或貴重之分析儀器如 Raman、SEM、TEM、XRD 等有一詳盡之瞭解，為往後學生在研究論文的性質檢測上所需之儀器分析上打下基礎。本課程的修習內容亦有助於學生將來利用儀器分析進行化工產品的分離、鑑定及成份分析的工作，不論是對學生在校學習及未來之工作均有很大的助益。另外，本課程在各單元的授課中均會提出一些目前此儀器之發展狀況與實際之問題與學生討論，在討論中培養學生有獨立思考問題的能力及掌握國際產業及科技方向的能力，為終身學習打下好的基礎。					
教科書 [1]	Principles of Instrumental Analysis, 6th ed., BROOKS/COLE, THOMSON, 2007.				

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		
Chromatographic Separations-GC,HPLC	層析之定性及定量分析與應用。層析之實務分析與此技術未來之發展。	1,2,3,4,5,6,7	1.瞭解層析之定性及定量分析與應用。2.能閱讀層析相關之論文或技術報告。3.能提出分析誤差產生時之改善意見。4.能瞭解層析在環境與食安上之重要性。
Molecular Absorption Spectrometry-UV-vis, FTIR, AA	分子及原子吸收光譜之定性及定量分析與應用。分子及原子吸收光譜法之實務分析與此技術未來之發展。	1,2,3,4,5,6,7	1.瞭解吸收光譜法之定性及定量分析與應用。2.能閱讀吸收光譜相關之論文或技術報告。3.能提出分析誤差產生時之改善意見。4.能瞭解吸收光譜法在材料研究、環境與食安上之重要性。
Atomic Emission Spectrometry-RS, AES	原子發射光譜之定性及定量分析與應用。原子發射光譜法之實務分析與此技術未來之發展。	1,2,3,4,5,6,7	1.瞭解發射光譜法之定性及定量分析與應用。2.能閱讀發射光譜相關之論文或技術報告。3.能提出分析誤差產生時之改善意見。4.能瞭解發射光譜法在材料研究、環境與食安上之重要性。
Light Scattering Spectrometry - Raman	分子散射光譜之定性及定量分析與應用。分子散射光譜法之實務分析與此技術未來之發展。	1,2,3,4,5,6,7	1.瞭解散射光譜法之定性及定量分析與應用。2.能閱讀散射光譜相關之論文或技術報告。3.能提出分析誤差產生時之改善意見。4.能瞭解散射光譜法在材料研究、環境與食安上之重要性。

Thermal Analytical Techniques-TGA,DTA, DSC	熱分析之定性及定量分析與應用。熱分析之實務分析與此技術未來之發展。	1,2,3,4,5,6,7	1.瞭解熱分析法之定性及定量分析與應用。2.能閱讀熱分析相關之論文或技術報告。3.能提出分析誤差產生時之改善意見。4.能瞭解熱分析法在材料研究、環境與食安上之重要性。
Nuclear Magnetic Resonance-NMR	核磁共振光譜之定性及定量分析與應用。核磁共振光譜之實務分析與此技術未來之發展。	1,2,3,4,5,6,7	1.瞭解核磁共振光譜之定性及定量分析與應用。2.能閱讀核磁共振光譜相關之論文或技術報告。3.能提出分析誤差產生時之改善意見。4.能瞭解核磁共振光譜在材料研究、環境與食安上之重要性。
X-Ray Spectrometry	X 射線光譜之定性及定量分析與應用。X 射線光譜法之實務分析與此技術未來之發展。	1,2,3,4,5,6,7	1.瞭解X射線光譜之定性及定量分析與應用。2.能閱讀 X 射線光譜相關之論文或技術報告。3.能提出分析誤差產生時之改善意見。4.能瞭解 X 射線光譜在材料研究、環境與食安上之重要性。
Electron Microscopy-SEM,TEM	電子顯微鏡、X 射線能譜及選區繞射之定性及定量分析與應用。電子顯微鏡之實務分析與此技術未來之發展。	1,2,3,4,5,6,7	1.瞭解電子顯微鏡之分析原理與應用。2.能閱讀電子顯微鏡相關之論文或技術報告。3.能提出分析誤差產生時之改善意見。4.能瞭解電子顯微鏡在材料研究、環境與食安上之重要性。

教學要點概述[2]：

參考教材：

(1)儀器分析，柯以侃編著，第 2 版，新文京出版，2002。

(2)林敬二、林宗義譯，儀器分析，第四版，美亞書局股份有限公司，臺北，1994。

教學方法：

本課程主要在講授儀器分析之相關的理論、設備及應用，教學以課堂理論講授為主，學生報告討論為輔。

評量方法：

(1)平時成績: 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 Instrumental Analysis

Credits / Hours	3/3	**Course Number**		☐**Required** ■**Elective**

Course Description

For improving the students' English ability and practical skills, this course uses English textbook and uses some published academic or industrial reports of instrumental analysis or equipment as the teaching materials. This course includes some general and precious instrumental analysis and their relative principles, equipment configuration, qualitative and quantitative methods, and related technologies. After completion of this course, the students shall have a detailed understanding not only on some common analytical instruments such as chromatographic analysis (GC and HPLC), optical spectroscopy (FTIR, UV-vis, AA, AES, PL), thermal analysis instruments (TGA, DSC, DTA), but also the expensive instruments such as Raman, SEM, TEM, XRD and so on. The content of this course will also help students in the future to apply the instrumental analysis on the separation, identification, qualitative and quantitative analysis for materials in school and future work. In addition, the curriculum taught in each topic will include the current state of development for the instrument and the actual discussion of the issues with students, which can train students the ability to think independently and to keep the ability for lifelong learning.

Course Topics

Topic	Content
Chromatographic Separations-GC,HPLC, GC/MS	This topic describes many issues of gas chromatography (GSC, GLC), liquid chromatography (HPLC), thin layer (TLC) and paper chromatography (PC), and GC/MS, including the principles of chromatography, important operating parameters, instrument configuration, detectors, analytical methods, and their applications.
Molecular Absorption Spectrometry- UV-vis, FTIR	This topic describes many issues of molecular absorption spectrometry such as UV-vis and FTIR, including the principles of molecular absorption spectrometry (Beer's law), type of instruments, important operating parameters, detection systems, analytical methods, and their applications.
Molecular Emission Spectrometry- PL	This topic describes many issues of molecular emission spectrometry for PL, including the principles of molecular emission spectrometry, type of instruments, important operating parameters, detection systems, analytical methods, and their applications.

Atomic Emission Spectrometry- AA, AES, ICP/OES	This topic describes many issues of molecular emission spectrometry such as AA, AES, and ICP/OES, including the principles of atomic emission spectrometry, sample atomization, inductively coupled plasma, type of instruments, interferences, important operating parameters, detection systems, analytical methods, and their applications.
Light Scattering Spectrometry- Raman	This topic describes many issues of molecular light scattering spectrometry for Raman emission spectrometry, including the theory of Raman spectroscopy, excitation system, instrumentation, important operating parameters, detection systems, analytical methods, and their applications.
Thermal Analytical Techniques- TGA,DTA, DSC	This topic describes three kinds of miscellaneous instrumental methods of chemical analysis, including Thermogravimetry (TGA), differential thermal analysis (DTA), and differential scanning calorimetry (DSC). The principles, instrumentation, important operating parameters, and their applications were discussed in this topic.
Nuclear Magnetic Resonance-NMR	This topic describes the nuclear magnetic resonance (NMR) spectroscopy. NMR is one of the most powerful tools for elucidating the structure of chemical species. The theory of NMR, chemical shift, instrumentation, important operating parameters, and their applications were discussed in this topic.
X-Ray Spectrometry	This topic describes the atomic X-Ray spectroscopy that is based on measurement of emission, absorption, scattering, fluorescence, and diffraction of electromagnetic radiation. X-Ray Spectrometry is widely used for the qualitative and quantitative determination of elements in the periodic table. The principles, chemical shift, instrumentation, important operating parameters, and their applications were discussed in this topic.