

## 课程详述

### COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 <b>Course Title</b>	分析化学实验 <b>Analytical Chemistry Laboratory</b>				
2.	授课院系 <b>Originating Department</b>	化学系 Department of Chemistry				
3.	课程编号 <b>Course Code</b>	CH207				
4.	课程学分 <b>Credit Value</b>	2				
5.	课程类别 <b>Course Type</b>	专业基础课 Major Foundational Courses				
6.	授课学期 <b>Semester</b>	秋季 Fall				
7.	授课语言 <b>Teaching Language</b>	中英双语 English & Chinese				
8.	授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） <b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	李晓华等，化学系，工程师 第一教学楼 537 室 lixh3@sustech.edu.cn 0755-8801-8738 Li Xiao-Hua etc., Chemistry Department, Lab Engineer Rm.537, No.1 Teaching Bldg. lixh3@sustech.edu.cn 0755-8801-8738				
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	无 NA				
10.	选课人数限额(可不填) <b>Maximum Enrolment (Optional)</b>	80				
11.	授课方式 <b>Delivery Method</b>	讲授 <b>Lectures</b>	习题/辅导/讨论 <b>Tutorials</b>	实验/实习 <b>Lab/Practical</b>	其它(请具体注明) <b>Other (Please specify)</b>	总学时 <b>Total</b>
	学时数 <b>Credit Hours</b>			64		64

12. 先修课程、其它学习要求 <b>Pre-requisites or Other Academic Requirements</b>	分析化学 (CH205)
13. 后续课程、其它学习规划 <b>Courses for which this course is a pre-requisite</b>	仪器分析原理 (CH305-1)、仪器分析实践 (CH305-2)
14. 其它要求修读本课程的学系 <b>Cross-listing Dept.</b>	

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

《分析化学实验》是化学专业学生的专业必修课之一，是理论课的延伸和发展，也是从事生命科学、环境、医药、材料、农业和地质等学科工作的基础。通过本课程的学习，旨在培养学生掌握基本概念和基本理论；培养学生从事理论研究和实际工作的能力。巩固学生的分析化学基础理论知识，掌握基本实验操作，培养严谨的科学态度以及独立思考、分析与解决问题的能力。

Analytical Chemistry Experiment is one of the required courses for chemistry majors. It is the extension and development of theoretical courses. It is also the basis for work in life sciences, environmental science, medicine, materials, agriculture and geology. Through the study of this course, our aim is to train students to master basic concepts and basic theories, to develop students' ability to engage in theoretical research and practical work. Consolidate the students' basic theoretical knowledge of analytical chemistry, master basic experimental operations, develop rigorous scientific attitudes, and the ability to think, analyze, and solve problems independently.

#### 16. 预达学习成果 Learning Outcomes

本课程以实验基础训练为目的，内容涵盖分析化学基本理论知识以及常用的分析仪器（容量分析仪器的校准、电导率仪、pH计的校准及样品测定，通过该实验让学生熟悉了解分析化学实验所用基本玻璃仪器和电子天平的使用，为接下来的分析化学滴定实验打下基础；工业纯碱总碱度的测定，水的总硬度测定，碘量法测定铜合金中铜的含量，尿素中氮的测定（甲醛法），铁矿（铁粉）中铁含量的测定（无汞定铁法）和胃舒平药片中铝含量的测定六个滴定实验涵盖了分析化学实验中几种滴定方式并且通过这些滴定实验让学生掌握基本的样品预处理；邻二氮菲分光光度法测定污水中铁的含量，K<sub>3</sub>Fe(CN)<sub>6</sub>在玻碳电极上的氧化还原，紫外光谱分析和定量测定氨基酸类物质，红外光谱法测定未知有机化合物，四个仪器实验让学生掌握四种常用的分析仪器的使用；期末实验操作考核，通过一学期的实验训练，在经过十一个独立分析实验操作培训的基础上对学生的基本实验操作进行实验操作考核）。通过分析化学实验课程的学习，锻炼学生实验动手能力，培养学生的实验技巧和从事科学研究的基本素质。

This course is designed for experimental basic training, it covers basic theoretical knowledge of analytical chemistry as well as common analytical instruments. (Calibration of Analysis Glassware and Calibration of Electrical Conductivity, pH Meter and Sample Determination, which allows students to familiarize themselves with the use of basic glass instruments and electronic balances used in analytical chemistry experiments. To lay the foundation for the next analytical chemical titration experiments. Determination of Total Alkalinity of Soda Ash, Determination of Water Hardness with EDTA, Iodometric Determination of Cu in Brass, Determination of Nitrogen Content in Ammonium Salts (Methanal Method), Analysis of An Iron or Ore by Titration with Potassium Dichromate and Determination of Aluminum in Gastropin Tablets. The six titration experiments covers several titration methods in analytical chemistry experiment and let the students master the basic sample pretreatment through these titration experiments. Colorimetric Fe Analysis, Redox K<sub>3</sub>Fe(CN)<sub>6</sub> on Glassy Carbon (GC) Electrode, UV-vis Spectrum Analysis and Quantitative Determination of Amino Acids, Infrared Spectrometry Unknown Organic Compound, Four instrument experiments let students master the use of four kinds of commonly used analytical instruments. At the end of the period, the experimental operation assessment will carried out. Through one semester of experimental training, after the 11 independent analysis and experimental operation training, the basic experimental operation of the students will be tested in the experimental operation.). Through the study of analysis chemistry experiment courses, the students' experimental ability is exercised, and the students' experimental skills and basic qualities of scientific research are cultivated.

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）  
**Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

### 绪论 (3 学时)

绪论课简单介绍上分析化学实验课所需注意安全要点、要做的实验、要掌握的基本知识点、实验成绩的组成, 进行分班分组, 让同学们确定实验地点、实验时间。

实验一(A): 容量分析仪器的校准 (3 学时)

实验一(B): 电导率仪、pH 计的校准及样品测定 (2 学时)

通过上述两个实验让学生熟悉了解分析化学实验所用基本玻璃仪器和电子天平的使用, 为接下来的分析化学滴定实验打下基础

实验二: 工业纯碱总碱度的测定 (4 学时), 酸碱滴定。

实验三: 水的总硬度测定 (5 学时), 络合滴定。

实验四: 碘量法测定铜合金中铜的含量 (5 学时), 碘量法。

实验五: 尿素中氮的测定 (甲醛法) (5 学时), 间接法, 并学习测定前的消化方法。

实验六: 铁矿(铁粉)中铁含量的测定 (无汞定铁法) (5 学时), 学习无汞定铁法, 增强环保意识。

实验七: 胃舒平药片中铝含量的测定 (6 学时), 学会使用水泵进行减压抽滤操作, 学习常用药品有效成分含量的检测。

上述六个滴定实验涵盖了分析化学实验中几种滴定方式并且通过这些滴定实验让学生掌握基本的样品预处理。

实验八: 邻二氮菲分光光度法测定污水中铁的含量 (5 学时), 痕量铁的检测以及使用分光光度计。

实验九:  $K_3Fe(CN)_6$  在玻碳电极上的氧化还原 (5 学时), 学会简单使用电化学工作站。

实验十: 紫外光谱分析和定量测定氨基酸类物质 (5 学时), 学会使用紫外可见分光光度计。

实验十一: 红外光谱法测定未知有机化合物(5 学时), 学会使用红外光谱仪。

上述四个仪器实验让学生掌握四种常用的分析仪器的使用

实验十二: 设计实验 (6 学时), 通过一学期的实验训练, 学会运用所掌握的实验基础自行设计简单的分析化学实验, 对本学期的实验学习有个直观的考核。

### Introduction (3 credit hours)

The introduction class simply introduce the safety essentials, the experiments to be done, the basic knowledge and the composition of the experimental results to be mastered in this Analytical Chemistry Experiment course, and the grouping of the classes. The students can know the location of the experiment and the time to do the experiment.

Experiment 1(A) Calibration of Analysis Glassware. (3 credit hours)

Experiment 1(B) Calibration of Electrical Conductibility, pH Meter and Sample Determination. (2 credit hours)

Above two experiments allows students to familiarize themselves with the use of basic glass instruments and electronic balances used in analytical chemistry experiments. To lay the foundation for the next analytical chemical titration

experiments.

Experiment 2 Determination of Total Alkalinity of Soda Ash, which is an acid-base titration. (4 credit hours)

Experiment 3 Determination of Water Hardness with EDTA, which is a complexometry titration. (5 credit hours)

Experiment 4 Iodometric Determination of Cu in Brass, which is an iodometry. (5 credit hours)

Experiment 5 Determination of Nitrogen Content in Ammonium Salts (Methanal Method), which is an indirect method and learn the digestive method. (5 credit hours)

Experiment 6 Analysis of An Iron or Ore by Titration with Potassium Dichromate. Lear about mercury-free analysis of iron and enhance environmental protection consciousness. (5 credit hours)

Experiment 7 Determination of Aluminum in Gastropin Tablets. Learn to use water pump for vacuum filtration, and learn the detection of the active ingredient content of commonly used drugs. (6 credit hours)

Above six titration experiments covers several titration methods in analytical chemistry experiment and let the students master the basic sample pretreatment through these titration experiments.

Experiment 8 Colorimetric Fe Analysis, the detection of trace concentrations of iron and learn how to use spectrophotometer. (5 credit hours)

Experiment 9 Redox  $K_3Fe(CN)_6$  on Glassy Carbon (GC) Electrode, learn how to simple use electrochemical workstation. (5 credit hours)

Experiment 10 UV-vis Spectrum Analysis and Quantitative Determination of Amino Acids, learn how to use UV-vis spectrophotometer. (5 credit hours)

Experiment 11 Infrared Spectrometry Unknown Organic Compound, learn how to use Fourier transform infrared spectrometer. (5 credit hours)

Above four instrument experiments let students master the use of four kinds of commonly used analytical instruments.

Experiment 12 Design Experiments. The final design experiment, through a semester of experimental training, learn to use the master of the experimental basis of their own design simple analytical chemistry experiment, for this semester's experimental learning has a visual assessment. (6 credit hours)

18. 教材及其它参考资料 Textbook and Supplementary Readings

《分析化学实验》和《Analytical Chemistry Experiment》

课程评估 ASSESSMENT

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance				
课堂表现 Class Performance				

小测验 Quiz				
课程项目 Projects				
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation				
其它(可根据需要 改写以上评估方 式) Others (The above may be modified as necessary)	一学期 One semester	<p>分析化学实验总成绩 = 80% × 平时实验成绩 + 20% × 期末实验操作考试成绩。</p> <p>(1) 平时实验成绩: 每一个实验满分 100 分 = 预习报告(10分) + Quiz(10分) + 课堂表现(20分) + 实验操作(30分) + 实验报告(30分)。所有 11 个分析化学实验的平时成绩占总成绩的 80%。若有一个实验没完成, 则该实验的成绩为 0。</p> <p>(2): 期末实验操作考试成绩满分 100 分, 占总成绩的 20%。</p> <p>(2) Overall = 80% experiment score at ordinary times + 20% final experiment operation test (1) Experiment score at ordinary times: 100 points for each experiment = Preview report (10) + quiz (10) + behaviors in classroom (5) + environmental cleaning (5) + ability in experiment operation (40) + lab report (30) (2) Final experimental operation test, 100 points total.report (30) (2) Grade of the design experiment and paper report: 100 points total.</p>		

20. 记分方式 GRADING SYSTEM

- A. 十三级等级制 Letter Grading  
 B. 二级记分制 (通过/不通过) Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过  
 This Course has been approved by the following person or committee of authority

化学系教学指导委员会  
 Teaching committee of the chemistry department