

## 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>	有机化学 II <b>Organic Chemistry II</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>	CH206
4.	课程学分 <b>Credit Value</b>	4
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>	春季 Spring
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)	李鹏飞, 助理教授, 化学系, <a href="mailto:li.pf@sustech.edu.cn">li.pf@sustech.edu.cn</a> 汪君, 助理教授, 化学系, <a href="mailto:wang.j@sustech.edu.cn">wang.j@sustech.edu.cn</a> 何川, 副教授, 化学系, <a href="mailto:hec@sustech.edu.cn">hec@sustech.edu.cn</a> 舒伟, 副教授, 化学系, <a href="mailto:shuw@sustech.edu.cn">shuw@sustech.edu.cn</a> Pengfei Li, Assistant Professor, Department of Chemistry, <a href="mailto:li.pf@sustech.edu.cn">li.pf@sustech.edu.cn</a> ; Jun Wang, Assistant Professor, Department of Chemistry, <a href="mailto:wang.j@sustech.edu.cn">wang.j@sustech.edu.cn</a> Chuan He, Associate Professor, Department of Chemistry, <a href="mailto:hec@sustech.edu.cn">hec@sustech.edu.cn</a> Wei Shu, Associate Professor, Department of Chemistry, <a href="mailto:shuw@sustech.edu.cn">shuw@sustech.edu.cn</a>
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	穆怀雪, 化学系, <a href="mailto:muhx@mail.sustech.edu.cn">muhx@mail.sustech.edu.cn</a> Huaixue Mu, Department of Chemistry, <a href="mailto:muhx@mail.sustech.edu.cn">muhx@mail.sustech.edu.cn</a>
10.	选课人数限额(可不填) <b>Maximum Enrolment (Optional)</b>	

11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
学时数 Credit Hours	64	0	0	0	64

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	有机化学 I (CH203)
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	现代策略合成 (CH311), 化学前沿研究 (CH210), 超分子化学 (CH308-14), 药物化学 (CH317)
14. 其它要求修读本课程的学系 Cross-listing Dept.	

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

作为 CH203 有机化学 I 的延续, 本门课的目的是在于结合 CH203 为有机化学学习奠定坚实的基础。本门课主要关注的是理解有机分子的结构及反应活性的基本原则, 并用实例去阐明有机化学的重要作用。

As a continuation from CH203 Organic Chemistry I, this course aims to provide a solid foundation of organic chemistry together with CH203. It focuses primarily on the basic principles to understand the structure and reactivity of organic molecules, with examples illustrating the role of organic chemistry in daily life and industry.

#### 16. 预达学习成果 Learning Outcomes

预期学习效果:

- 1 能够准确的画出有机分子的结构表达式;
- 2 理解有机分子结构和反应活性的基本原则;
- 3 能够根据色谱数据判断出有机化合物的结构;
- 4 能够合理的解释常见官能团的转换机制 (醇、醚、羟基化合物、醛、酮、酰卤化合物、羧酸酐、酯类、酰胺、氰类和胺);
- 5 设计有机化合物的合成路线。

On successful completion of this course, students should be able to:

- 1 draw correct structural representations of organic molecules;
- 2 understand the basic principles of structure and reactivity of organic molecules;
- 3 determine structures of organic compounds based on spectroscopic data;
- 4 write reasonable mechanisms for transformations of common functional groups (alcohols, ethers, carbonyl compounds, aldehydes, ketones, carboxylic acids, acyl halides, anhydrides, esters, amides, nitriles, and amines);
- 5 devise synthetic pathways to organic compounds using functional group chemistry;

#### 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.)**

## Chapter 15 Ethers, Epoxides, and Sulfides

Nomenclature of ethers, epoxides and sulphides; Physical properties of ethers; Spectroscopy of ethers; Synthesis of ethers; Cleavage of ethers by HBr and HI; Autoxidation of ethers; Synthesis of epoxides; Acid-catalyzed ring opening of epoxides; Base-catalyzed ring opening of epoxides; Orientation of epoxide ring opening; Reactions of epoxides with Grignard and organolithium reagents; Epoxy Resins: The advent of modern glues; Sulfides (Thioethers). (6 credit hours)

### 第十五章 醚、环氧化合物和硫化物

醚、环氧化合物和硫化物的命名；醚的物理性质；醚的光谱特征；醚的合成；HBr、HI对醚的碳氧键断裂反应；醚的自身氧化；环氧化合物的合成；酸催化环氧化合物的开环反应；碱催化的开环反应；环氧化合物开环反应的取向；环氧化合物与格氏试剂和有机锂的反应；环氧树脂；现代胶水的出现；硫化物。6个学时

## Chapter 16 Aromatic Compounds

The discovery of benzene; Nomenclature of aromatic compounds; The structure and properties of benzene; The molecular orbitals of benzene; Aromatic, antiaromatic, and nonaromatic compounds; Hückel's Rule; Molecular Orbital Derivation of Hückel's Rule; Aromatic ions; Heterocyclic aromatic compounds; Polynuclear aromatic hydrocarbons; Aromatic allotropes of carbon; Fused heterocyclic compounds; Physical properties of benzene and its derivatives; Spectroscopy of aromatic compounds. (4 credit hours)

### 第十六章 芳基化合物

苯的发现；芳基化合物的命名；苯的结构与性质；苯的分子轨道；芳基化合物、反芳基化合物和非芳基化合物；Hückel's规则；Hückel's规则引出分子轨道；芳基离子；杂环芳香族化合物；多核芳香族碳氢化合物；芳香碳的同素异形体；稠杂环化合物；苯及其衍生物的物理性质；芳香族化合物的光谱特征。4个学时

## Chapter 17 Reactions of Aromatic Compounds

Electrophilic aromatic substitution; Halogenation of benzene; Nitration of benzene; Sulfonation of benzene; Nitration of toluene: the effect of alkyl substitution; Activating, ortho, para-directing substituents; Deactivating, meta-directing substituents; Halogen substituents: deactivating, but ortho, para-directing; Effects of multiple substituents on electrophilic aromatic substitution; The Friedel-Crafts alkylation; The Friedel-Crafts acylation; Nucleophilic aromatic substitution; Addition reactions of benzene derivatives; Side-chain reactions of benzene derivatives; Reactions of phenols. (8 credit hours)

### 第十七章 芳香族化合物的反应

亲电芳烃的取代；苯的卤代反应；苯的硝基化；苯的磺基化；甲苯的硝化；芳基取代的影响；邻位、对位取代的活化；间位取代的去活化；卤代反应；除邻位、对位取代的去活化；多取代基对亲电芳基取代的影响；傅克烷基化；傅克酰基化；亲核性芳基取代；苯衍生物的加成反应；苯衍生的侧链反应；酚的反应。8个学时

## Chapter 18 ketones and aldehydes

Nomenclature of ketones and aldehydes; Structure of the carbonyl group; Physical properties of ketones and aldehydes; Spectroscopy of ketones and aldehydes; Industrial importance of ketones and aldehydes; Syntheses of ketones and aldehydes; Reactions of ketones and aldehydes: nucleophilic addition; Hydration of ketones and aldehydes; Formation of acetals; Formation of Cyanohydrins; Formation of Imines; Condensations with hydroxylamine and hydrazines; The Wittig reaction; Oxidation of aldehydes; Reductions of ketones and aldehydes. (8 credit hours)

### 第十八章 酮和醛

酮和醛的命名；羰基的结构；酮和醛的物理性质；酮和醛的光谱特征；醛和酮的工业应用；合成醛和酮；醛和酮的反应；亲核加成；醛和酮的氢化；缩醛树脂的形成；氰醇的形成；亚胺的形成；羟胺和胍缩合反应；Wittig反应；醛的氧化反

应；酮和醛的还原。8 个学时

## Chapter 19 Amine

Nomenclature of amines; Structure of amines; Physical properties of amines; Basicity of amines; Effects on amine basicity; Salts of amines; Amine salts as phase-transfer catalysts; Spectroscopy of amines; Aromatic substitution of arylamines and pyridine; Alkylation of amines by alkyl halides; Acylation of amines by acid chlorides; Formation of sulphonamides; Amines as leaving groups: the Hofmann elimination; Oxidation of amines; the cope elimination; Reactions of amines with nitrous acid; Reactions of arenediazonium salts; Synthesis of amines by reductive amination; Synthesis of amines by acylation-reduction; Syntheses limited to primary amines. (6 credit hours)

### 第十九章 胺

胺的命名；胺的结构；胺的物理性质；胺的碱性；胺碱性的影响因素；胺盐；胺盐是一种相转换催化剂；胺的光谱性质；芳香胺和吡啶的芳香取代；烷基化生成烷基卤代胺；酰化反应生成胺酰氯；磺胺类化合物的形成；胺作为离去基团；Hofmann 消除反应；胺的氧化反应；消除反应的处理；胺与亚硝酸的反应；芳基重氮的反应；还原胺化的作用合成胺；酰化作用生成胺；一级胺的合成限制。6 个学时

## Chapter 20 Carboxylic Acids

Nomenclature of carboxylic acids; Structure and physical properties of carboxylic acids; Acidity of carboxylic acids; Salts of carboxylic acids; Commercial sources of carboxylic acids; Spectroscopy of carboxylic acids; Synthesis of carboxylic acids; Condensation of acids with alcohols: the Fischer esterification; Esterification using diazomethane; Condensation of acids with amines: direct synthesis of amides; Synthesis and Use of Acid Chlorides; Reduction of carboxylic acids; Alkylation of carboxylic acids to form ketones. (6 credit hours)

### 第二十章 羧酸

羧酸的命名；羧酸的结构和物理性质；羧酸的酸性；羧酸盐；羧酸的市场来源；羧酸的光谱性质；羧酸的合成；酸和醇的缩合反应；Fischer 酯化反应；应用重氮甲烷酯化；酸和胺的缩合反应；直接合成胺；酸性氯化物的合成与应用；羧酸的还原；羧酸的烷基化生成酮。6 个学时

## Chapter 21 Carboxylic Acids Derivatives

Structure and nomenclature of acid derivatives; Physical properties of carboxylic acid derivatives; Spectroscopy of carboxylic acid derivatives; Interconversion of acid derivatives by nucleophilic acyl substitution; Transesterification; Hydrolysis of carboxylic acid derivatives; Reduction of acid derivatives; Reactions of acid derivatives with organometallic reagents; Esters and Amides of Carbonic Acid. (4 credit hours)

### 第二十一章 羧酸衍生物

酸衍生物的结构与命名；羧酸衍生物的物理性质；羧酸衍生物的光谱特征；亲和酰取代的羧酸衍生物的相互转化；酯交换；羧酸衍生物的水解；羧酸衍生物的花园；羧酸衍生物和有机金属试剂的反应；碳酸酯和酰胺。4 个学时

## Chapter 22 Condensations and Alpha Substitutions of Carbonyl Compounds

Enols and enolate ions; Alpha halogenation of ketones;  $\alpha$ -Bromination of acids: The HVZ reaction; Alkylation of enolate ions; Formation and alkylation of enamines; The Aldol condensation of ketones and aldehydes; Dehydration of Aldol products; Crossed Aldol condensations; Aldol cyclizations; The Claisen ester condensation; The Dieckmann condensation: A Claisen cyclization; Crossed Claisen Condensations; Syntheses using  $\beta$ -dicarbonyl compounds; The Malonic ester synthesis; The acetoacetic ester synthesis; Conjugate additions: the Michael reaction; The Robinson annulation. (8 credit hours)

### 第二十二章 羰基化合物的羰基缩合和 Alpha 取代

烯醇和烯醇离子；Alpha 卤代酮； $\alpha$  溴代酸；HVZ 反应；烯醇离子的烷基化；烯胺的形成和烷基化；酮和醛的醇醛缩合；

脱水的醇醛产物；交叉的醇醛缩合；醇醛环化；Claisen 酯缩合；Dieckmann 缩合；Claisen 环化；交叉 Claisen 缩合；应用  $\beta$ -dicarbonyl 化合物合成；丙二酸酯的合成；乙酰乙酸酯合成；共轭加成；Michael 反应；Robinson 环状结构。8 个学时

#### Chapter 23 Carbohydrates and Nucleic Acids

Classification of carbohydrates; Monosaccharides; Erythro and threo diastereomers; Epimers; Cyclic structures of monosaccharides; Anomers of monosaccharides; mutarotation; Reactions of monosaccharides: side reactions in base; Reduction of monosaccharides; Oxidation of monosaccharides; reducing sugars; Nonreducing sugars: formation of glycosides; Ether and ester formation; Reactions with phenylhydrazine: osazone formation; Chain shortening: The Ruff degradation; Chain lengthening: The Kiliani-Fischer synthesis; Fischer's proof of the configuration of glucose; Determination of ring size; periodic acid cleavage of sugars; Disaccharides; Polysaccharides; Nucleic acids: introduction; Ribonucleosides and Ribonucleotides; The structure of Ribonucleic acid; Deoxyribose and the structure of deoxyribonucleic acid; Additional functions of nucleotides. (6 credit hours)

#### 第二十三章 碳水化合物与核酸

碳水化合物的分类；单糖；赤式和苏式非对映异构体；异构体；单糖的环状结构；单糖的差向异构体；旋光性；单糖的反应；碱中的副反应；单糖的还原反应；单糖的氧化反应；还原糖；非还原糖；葡萄糖的形成；酯和醚的形成；苯肼的反应；脎的形成；链的缩短；Ruff 降解；链的增长；Kiliani-Fischer 合成；Fischer 证明了葡萄糖的构型；测量和换的大小；高碘酸裂解糖；双糖；多糖；核酸；简介；核糖核苷和核苷酸；核糖核酸的结构；脱氧核糖和脱氧核糖核酸的结构；核苷酸的加成作用。6 个学时

#### Chapter 24 Amino Acids, Peptides, and Proteins

Structure and stereochemistry of the  $\alpha$ -amino acids; Acid-base properties of amino acids; Isoelectric points and electrophoresis; Synthesis of amino acids; Resolution of amino acids; Reactions of amino acids; Structure and Nomenclature of Peptides and Proteins; Peptide structure determination; Solution-phase peptide synthesis; Solid-phase peptide synthesis; Classification of proteins; Levels of protein structure; Protein denaturation. (4 credit hours)

#### 第二十四章 氨基酸、多肽和蛋白质

$\alpha$ -氨基酸的结构和立体化学；氨基酸的酸碱性质；等电点和电泳；氨基酸的合成；氨基酸的拆分；氨基酸的反应；多肽和蛋白质的命名以及结构；多肽结构的鉴定；液相肽合成；固相肽合成；蛋白质的分类；蛋白质结构的分级；蛋白质的变性。4 个学时

#### Chapter 25 Lipids

Waxes; Triglycerides; Saponification of fats and oils; soaps and detergents; Phospholipids; Steroids; Terpenes; Prostaglandins. (2 credit hours)

#### 第二十五章 脂

蜡；甘油三酸酯；脂肪和油脂的皂化；肥皂和洗涤剂；磷脂；类固醇；萜烯；前列腺素。2 个学时

#### Chapter 26 Pericyclic Reactions

Cycloaddition (allowed - forbidden), electrocyclic reactions (conrotatory - disrotatory), sigmatropic rearrangements (suprafacial - antarafacial). (2 credit hours)

#### 第二十六章 周环反应

环加成；电环化反应；sigma 重排。2 个学时

现用教材 (textbook): L. G. Wade, Jr 《Organic Chemistry》 (Eighth Edition) Pearson International Edition, ISBN-13: 978-0-321-81139-4, ISBN-10: 0-321-81139-9。

参考教材 (supplementary reading): 邢其毅、裴伟伟、徐瑞秋、裴坚主编。《基础有机化学》(第三版, 上、下册) 高等教育出版社, 2005。

### 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		0		
课堂表现 Class Performance		0		
小测验 Quiz		0		
课程项目 Projects		0		
平时作业 Assignments		10		
期中考试 Mid-Term Test		30		
期末考试 Final Exam		60		
期末报告 Final Presentation		0		
其它 (可根据需要 改写以上评估方 式) Others (The above may be modified as necessary)				

### 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