厦门大学本科课程教学大纲

<table>
<tr><td>课程名称</td><td colspan="2">中心科学实验 III</td><td>所属
课程组</td><td>基础化学实验（三）（仪器分析实验）课程组</td></tr>
<tr><td>课程代码</td><td colspan="2">U10302100373</td><td>英文
类别代号</td><td>CHEM</td></tr>
<tr><td>适用专业</td><td colspan="4">化学类</td></tr>
<tr><td>课程类型</td><td colspan="2">学科通修课程</td><td>课程课型</td><td>实验课</td></tr>
<tr><td>总学分</td><td>总学时</td><td>理论教学学时</td><td>实验教学学时</td><td>实践教学学时</td></tr>
<tr><td>6</td><td>192</td><td>28</td><td>108</td><td>56</td></tr>
<tr><td>先修课程</td><td colspan="4">中心科学实验 I、中心科学实验 II</td></tr>
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一、课程简介

该课程设置模块化、分层次实验体系。让学生通过综合实验充分认识多学科交叉融合研究领域，开拓研究视野，夯实专业基础，储备各方向发展所需的基本技能和前沿技术。课程内容主要分为“化学合成与表征”和“化学原理与测量”两个模块。该课程开课对象为中心科学实验班本科二年级学生。

二、培养目标

“中心科学实验 III”课程与其他中心科学课程体系协同，突出对科学深入而融会贯通的特点，实现多学科深度整合。该课程所涉及的前沿知识及综合实验技术将帮助学生通过不同的视角理解化学学科。同时，所设置的模块化综合实验开放性、场景化及项目式的实验设计激发学生兴趣和自主性，引导、发现、培育学生的创新意识和实践能力，促进拔尖创新人才培养。

三、课程思政目标

实验课中通过学习合成、表征、应用等，培养学生严格规范的实验操作能力，建立严谨细心、求真求实、客观理性的科学品德，感受知识的力量和技术的魅力，并通过了解化学发展史，增强民族自信力。

四、教学方法

课堂讲授、演示和实验操作训练，多媒体辅助，并灵活采用启发式、互动式和项目式多种教学方式。

五、主要内容及学时安排（融入课程思政内容）

章（或节、实验项目）	主要内容	课程思政映射与融入点	学时安排	实验项目类型（实验项目填写）	是否虚/实（实验项目填写）	实验项目修读要求（实验项目填写）
绪论	课程简介及安全教育	职业健康	2	演示性	真实实验	必做
	金属有机试剂的制备	以诺奖故事为切入点，培养学生探究与创新精神，树立正确的人生态度与价值观	12	研究性	真实实验	选做
	小分子催化不对称 Mannich 反应	以科技前沿的“有机小分子不对称催化”为切入点，启发学生的学科兴趣。	12	研究性	真实实验	选做
	电化学合成	从绿色环保的合成技术，引入环境保护理念。	12	研究性	真实实验	选做
	物质结构的表征技术	从结构表征引入去伪存真，感受知识的力量和技术的魅力。	36	研究性	真实实验	必做
计算化学	计算化学实验	从计算化学引入我国理论与计算化学学科的发展史及科学家埋头苦干的精神，形成协同育人效应。	24	研究性	真实实验	选做
化学原理与测量	电极反应动力学	从电化学仪器引入我国的电化学发展史及科学家精神，激发学生创新意识。	12	研究性	真实实验	必做
	光催化反应动力学	从光催化实验引入认识化学在推进新能源利用技术发展中的关键作用，使学生理解新能源利用对实现“碳中和”重大战略目标的意义。	12	研究性	真实实验	必做
	复杂体系中微量、痕量组分分析	介绍我国色谱学科从无到有，从初步创立到广泛应用，从跟跑到领跑的发展历程，建立民族自信心。	24	研究性	真实实验	必做

	分析仪器的搭建、调试及应用	通过让学生自主搭建和调试仪器，提升实践能力和知识综合应用能力，打破了学生对科学仪器的神秘感，激发学习兴趣与好奇心，培养学生的实践能力和创新意识。	12	研究性	真实实验	选做
其他	自动化合成	引导学生追求技术创新，体现精益求精的工匠精神	12	研究性	真实实验	选做
	PEM 电解水	通过我国在质子交换膜电解槽铱基催化剂和氢气检测标准的自主创新成果，激发学生科技报国情怀	12	研究性	真实实验	选做
期末复习	期末复习		10		真实实验	选做
合计			192			

六、考核方式与要求

课程成绩为平时成绩 80%，考查实验 20%。平时成绩包括预习、实验操作、实验结果、实验报告等。成绩登记方式为等级制成绩。

七、选用教材/教辅材料	自编讲义，2021.8，文本类教材。
八、主要文献资料或相关数据库	1. 《小量-半微量-微量有机化学实验》，林敏，周金梅，阮永红编著，高等教育出版社，2010； 2. 《分析化学》，下册，武汉大学主编，高等教育出版社，2018； 3. 《物理化学实验》，韩国彬，夏文生主编，厦门大学出版社，2020。
九、课程网站等支持条件	course.xmu.edu.cn
十、其它信息	

大纲制定者：王翊如　　大纲审定者：邓顺柳　　大纲制定时间：2025.6.28

XMU Undergraduate Course Syllabus

<table>
<tr><td>Course name</td><td colspan="2">Experimental Central Science III</td><td>Course group</td><td colspan="2">Basic Chemistry Experiment (III) (Experiments of Instrumental Analysis)</td></tr>
<tr><td>Course code</td><td colspan="2">U10302100373</td><td>Category code</td><td colspan="2">CHEM</td></tr>
<tr><td>Course can be shared with</td><td colspan="5">Chemistry</td></tr>
<tr><td>Course type</td><td colspan="2">☐Basic Common Courses 公共基本课程
☐General Education Courses 通识教育课程
■Disciplinary General Courses 学科通修课程
☐Specialized Courses 学科或专业方向性课程
☐Other 其它教学环节
☐Disciplinary Courses 专业课程
☐Electives Courses 任选课程
☐Extra Courses 方案外课程</td><td>Course focus</td><td colspan="2">□Lecture
■Experiment
□Skill-training
□Practical
□Lecture + Experiment
□Lecture + Practical</td></tr>
<tr><td>Credit</td><td>Total learning hours</td><td>Lecture</td><td colspan="2">Experiment</td><td>Practical</td></tr>
<tr><td>6</td><td>192</td><td>28</td><td colspan="2">108</td><td>56</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Experimental Central Science I, Experimental Central Science II</td></tr>
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1.Course description

The course has a modular and hierarchical experimental system. Through comprehensive experiments, students can fully understand the interdisciplinary research field, expand the research horizon, consolidate the professional foundation, and reserve the basic skills and cutting-edge technology needed for development in various directions. The course content is divided into chemical principles and measurement, synthetic chemistry and characterization. The experimental content is integrated, interesting, exploratory, and innovative.

2. Learning goals

The Experimental Central Science III is highly coordinated with central science curriculum systems, which highlight the characteristics of in-depth and comprehensive science, enables students to deepen their understanding of theoretical knowledge and learn to actively explore new knowledge. The cutting-edge knowledge and comprehensive laboratory techniques will help students understand chemistry from different perspectives. The open and scene experiment design will stimulate students' interest in learning, cultivate students' innovative consciousness and practical ability.

3. Moral education goals

Through the study of synthesis, characterization and application in this course, students will develop the ability to conduct standard experiment operation, build up a rigorous and careful, truth-seeking, objective and rational scientific character, feel the power of knowledge and the charm of technology, and enhance national self-confidence through an understanding of the history of chemistry.

4.Teaching approaches

The teaching approaches of this course include (1) preview literature; (2)lectures about experimental principle; (3) tutorial in experiments; (4) evaluation of students' reports.

5. Content outline of the course (including moral education elements)

Chapter (Section or experi-mental item)	Content	Main point of moral education	Learn-ing hours	Type of experi-mental item	Real experi-ment or virtual simulation experiment	Requir-ement of experi-mental item
Introduc-tion	Experimental Requirements, Safety Knowledge	Occupational health	2	Demon-strative	Real experiment	Must do
	Preparation of Organometallic reagent reagent	Using the Nobel Prize story as an entry point to develop students' spirit of inquiry and innovation, and to establish the right attitude and values.	12	Research-based	Real experiment	Optional
	Asymmetric Mannich reaction catalyzed by small molecules	Students are inspired by the science and technology frontier of "asymmetric catalysis of organic small molecules".	12	Research-based	Real experiment	Optional
	Electrochemical synthesis	Introducing environmental protection from green and environmentally friendly synthetic technologies	12	Research-based	Real experiment	Optional

	Characterization technology	We introduce the power of knowledge and technology from structural representation to de-falsification.	36	Research-based	Real experiment	Must do
Compu-tational chemistry	Computational chemistry experiment	The history of the development of the discipline of theoretical and computational chemistry in China and the spirit of scientists are introduced from computational chemistry.	24	Research-based	Real experiment	Optional
Chemical principle and measure-ment	Kinetics of electrode reaction	Introduce the history of electrochemistry development and scientist spirit in China from electrochemical instruments to stimulate students' sense of innovation.	12	Research-based	Real experiment	Must do
	Kinetics of photocatalytic reaction	Students will be introduced to the key role of chemistry in promoting the development of new energy utilization technologies through photocatalysis experiments, and will understand the significance of new energy utilization in achieving the major strategic goal of "carbon neutrality".	12	Research-based	Real experiment	Must do

	Trace analysis in complex system	Introducing the development of chromatography in China from scratch, from its initial creation to widespread use, and from a follower to a leader, and building national self-confidence.	12	Research-based	Real experiment	Must do
	Construction, adjustment and application of analytical instrument	By allowing students to build and debug instruments on their own, they enhance their practical skills and comprehensive application of knowledge, break the mystery of scientific instruments, stimulate interest and curiosity in learning, and develop their practical skills and sense of innovation.	12	Research-based	Real experiment	Optional
Others	Automated Synthesis	Guide students to pursue technological innovation, embodying the spirit of craftsmanship that strives for perfection.	12	Research-based	Real experiment	Optional
	Electrolysis Water by PEM	Through China's independent innovations in iridium-based catalysts for proton exchange membrane electrolyzers and hydrogen detection standards, we inspire students to embrace a passion for serving the nation through science and technology.	12	Research-based	Real experiment	Optional
	Review		10			

Total	192

6. Assessment methods and requirements

The assessment of a student's grade in this course will be according to average score of all experiments（80%）and examination experiment (20%) . And each experiment score will be according to his/her performance of:

(1) Preparatory reading
(2) Operation in experiments
(3) Results
(4) Reports

7.Textbooks/ References	Handout by Instructor, 2021.8
8.Major literature or related databases	1. Trace Organic chemistry experiment, Min Lin, Jinmei Zhou, Yonghong Ruan, High Education Press, 2010. 2. Analytical Chemistry, Wuhan University, Higher Education Press, 2018. 3. Physical chemistry experiments, Guobin Han, Wensheng Xia, Xiamen University Press, 2020.
9.Website	course.xmu.edu.cn
10.Others	

Filled out by: Yiru Wang Approved by: Shunliu Deng Date: Jun 28, 2025