博士留学生课程简介及大纲（2022 修订双语版）

The Doctor Degree Course Introduction and Syllabus for Overseas Postgraduate Students (2022 Bilingual version)

《食品工程中的数学建模》课程简介

课程名称： 食品工程中的数学建模

课程编码：EB083200B1801

授课对象：食品科学与工程专业博士研究生

学　　分：2

学　　时：36 （其中实验 9 学时）

课程内容：

1:（思政目标）注重强化学生数学逻辑教育，激发学生科技报国的家国情怀和使命担当；培养学生“大国三农”情怀，增强学生服务农业现代化的使命感和责任感；

本课程是一门实践性较强的研究生学位基础课。主要讲授食品科学与工程学科研究过程中的物理、化学、生物等相关科学中的客观关系，通过运用分析工具建立数学模型，充分挖掘试验数据中的规律，科学推导或演绎出未知的结果。目的是提高学生运用数学分析方法解决实验数据处理的能力，提升创新能力，为发现科学研究中新的潜在规律提供必要的解决方案和手段。

第一章　绪论，包括本课程在食品科学与工程专业课程中的地位，以及学习该课程的意义，了解数学建模解决的问题方案和主要的解决方法。 **注重讲述数学逻辑思维的重要性和科技报国的家国情怀。**

第二章　常用数学模型的介绍，包括模型变量的筛选，模型特征的提取，主成分分析，偏最小二乘模型和支持向量机模型的建立等。

第三章　模式识别及可视化模型的建立，包括概述，聚类分析，线性判别分析，定量分析，模式识别模型和可视化模型的建立，模型在食品检测中的应用实例。

第四章　多传感信息融合模型的建立，包括多传感器信息融合原理介绍，神经网络的建模方法，融合检测系统的研究实例。

第五章　常用数据统计方法与分析软件介绍，包括化学计量学方法简介、SPSS 软件系统、Origin 等软件系统简介。

Introduction of the Course: Mathematical Modeling in Food Engineering

Course Name：Mathematical Modeling in Food Engineering

Credit：2

Teaching hours：32

Contents of the Syllabus：

This course is a practical basic course for graduate degree. It mainly teaches the objective relations in physics, chemistry, biology and other related sciences in the research process of food science and engineering. Through the using of analysis tools to establish mathematical models, fully excavate the rules in the test data, and scientifically deduce or deduce the unknown results. The purpose is to improve the students' ability to deal with experimental data by using mathematical analysis methods, enhance their innovation ability, and provide necessary solutions and means for discovering new potential laws in scientific research.

Main contents of this course：

Chapter 1 Introduction to the place of the course in the food science and engineering specialization curriculum, and the significance of studying the course, understanding the problem solutions solved by mathematical modeling and the main solutions.

Chapter 2 Introduction to commonly used mathematical models, including the screening of model variables, the extraction of model features, principal component analysis, partial least squares models and the establishment of support vector machine models.

Chapter 3 Introduction to establishment of pattern recognition and visualization models, including overview, cluster analysis, linear discriminant analysis, quantitative analysis, establishment of pattern recognition models and visualization models, and application examples of models in food testing.

Chapter 4 Introduction to the establishment of multi-sensor information fusion model, including the introduction of multi-sensor information fusion principles, the modeling method of neural networks, and the research examples of fusion detection systems.

Chapter 5 Introduction to Common Data Statistics Methods and Analytical Software, including Introduction to Stoichiometry Methods, SPSS Software System, Origin and Other Software Systems.

《食品工程中的数学建模》教学大纲

一、课程基本信息

适用学科和学位类别：食品科学与工程，博士；

课程名称: 食品工程中的数学建模；

(英文名称): Mathematical Modeling in Food Engineering；

课程编码：EB083200B1801；学分：2；计划学时：36（其中实验 9 学时）；

课程类别：学位基础课；开课学期：第1学期；开课单位：食品科学与工程；

先修课程：高等数学、数值分析、数理统计、复变函数、食品工程原理。

二、教学目的

思政目的：注重强化学生数学逻辑教育，激发学生科技报国的家国情怀和使命担当；培养学生“大国三农”情怀，增强学生服务农业现代化的使命感和责任感；

在完成基础数学与应用数学的基础上，为了使博士生能将食品科学与工程方向研究过程中的物理、化学、物理化学以及化学物理等相关科学中客观关系采用数学语言（关系表达式）来描述，通过建立的数学模型充分挖掘试验数据中带有普遍性的规律，科学推导或演绎出未知的结果，为发现科学研究中新的潜在规律提供必要的解决方案和手段是本课程的目的所在。

通过该课程的学习为今后从事食品科学和工程的科学研究，以及开拓新的加工方法、新的加工工艺的发明充实基础。

三、教学方式

融合教学（教师 PPT 讲授+案例教学+PBL 教学+学生分组研讨）

四、课程内容、学时分配

（一） 导论 （3 学时）

1．教学内容

（1）《数学建模》在食品科学与工程专业课程中的地位，以及学习该课程的意义；

（2）了解数学建模解决的问题方案和主要的解决方法；

（3）实验数据的获取及预处理；

（4）误差的来源与控制。

（5）思政：**强化学生数学逻辑教育，激发学生科技报国的家国情怀和使命担当；培养学生“大国三农”情怀，增强学生服务农业现代化的使命感和责任感；**

2．基本要求

了解学习该课程的意义，理解《数学建模》在探究食品科学与工程中规律性数学表达方法的作用，掌握学习该课程的主要解决方法和方法，增加对误差的认识，初步掌握误差的分析方法和误差的传递规律。拓展食品科学与工程专业博士研究生的科学思路。

（二） 常用数学模型的介绍 （3 学时）

1．教学内容

（1） 模型变量的筛选；

（2） 模型特征的提取；

（3） 主成分分析和偏最小二乘模型的建立；

（4） 支持向量机模型的建立等。

2．基本要求

通过简单的采用初等数学方案的建模过程的体验，使食品科学与工程专业的博士掌握采用初等数学方法解决科学研究中数据的归纳、统计和分析的方法，解决一些规律性不太明朗的、离散数据的近似解方案。重点介绍主成分分析、偏最小二乘模型和支持向量机模型的建立方法。

（三） 模式识别及可视化模型的建立 （3 学时）

1．教学内容

（1）概述；

（2）聚类分析、线性判别分析、定量分析。

（3）模式识别模型的建立；

（4）可视化模型的建立；

（5）模型在食品检测中的应用实例。

2．基本要求

食品科学与工程需要解决的问题就是希望能直观判别加工和流通环节中的复杂检测结果，本章介绍的各种模型的建立方法就是为了达到上述目的而设置的。着重介绍模式识别模型、可视化模型的建立，以及模型在食品检测中的应用实例。

（四） 多传感信息融合模型的建立 （3 学时）

1．教学内容

（1）多传感器信息融合原理介绍；

（2）神经网络的建模方法；

（3）融合检测系统的研究实例；

（4）光谱分析技术的预测模型的建立。

2．基本要求

本章主要介绍的是采用信息融合方法建立模型，通过研究给定的某种任务和可以得到的各种信息资源，有效的组织和利用多源信息。需要学生掌握多传感融合模型中信息融合原理及应用方法，通过数据的组合推导出更多可用信息。

（五） 常用数据统计方法与分析软件介绍 （3 学时）

1．教学内容

（1）化学计量学方法简介；

（2）模型的准确度、稳定性和适用性的评价方法；

（3）Origin 软件系统；

（4）SPSS 软件。

2．基本要求

了解化学计量学的诞生和发展的基本过程，了解化学计量学研究和解决的问题，掌握化学计量学中最基础的数学处理方法，了解评价数学模型的准确度、稳定性和适用性的评价方法和最优模型的选择原则。介绍目前比较流行的数据处理和建立数学模型的软件系统，为建立和求解数学模型提供必要的数学工具和模型的实用性奠定基础。

（六） 学生专题汇报 （12 学时）

章　节	讲课	实验	上机
第一章　绪论	3		
第二章　常用数学模型的介绍	3		
第三章　模式识别及可视化模型的建立	3		
第四章　多传感信息融合模型的建立	3		
第五章　常用数据统计与分析软件介绍	3		
第六章　学生专题汇报	12	9	
合　计	27	9	

五、课程考核

学生研讨表现 40%（过程考核）+作业报告 60%（期末考核）

六、参考书目及学习资料

教材：姜启源等主编. 《数学模型（第四版）》 北京：高等教育出版社.2015 年

参考书：陈光亭，裘哲勇 编，《数学建模》，高等教育出版社，2000 年。

必读参考资料：[美] 米尔斯切特（Mark M. Meerschaert） 著；刘来福，黄海洋，杨淳 译，数学建模方法与分析（原书第 4 版） [Mathematical Modeling (Fourth Edition)]，机械工业出版社，2015 年

七、大纲说明

大纲编写说明：

1、本课程是食品科学与工程专业的数学模型课程的最低要求，可根据具体情况增加课堂教学和实验项目；教学过程中适当引入思政元素。

2、本课程的先期课程是在物理学、食品物料学、分析化学、仪器分析等基础课程上。要求学生基本掌握高等数学、数值分析、数理统计、复变函数等应用数学课程；

3、本课程的具体要求将课程教学内容分二个档次，即掌握和了解，掌握是指对教学内容理解透彻、清楚，并具有应用所学知识解决实际问题的能力；了解是指教学内容具有基本知识，拓宽知识面，为今后从事实际工作打下基础。

大纲撰写人 ：王成全

审核人（分管院长）：张红印

Course name: Mathematical Modeling in Food Engineering

Course code: EB083200B1801

I、Scheduled Teaching hours： **36** （experiments: 9 hours） **credits：** **2** ； **Course type：** **Degree Foundation Courses** ；**Opening semester：** **Autumn** semester； **Assessment method：** Written activity report ； **Opening unit：** **School of Food Science and Engineering .**

II、Applicable disciplines and professional degree categories：

Ph.D in food science and engineering.

III、Prerequisite course：

Advanced Mathematics, Numerical Analysis, Mathematical Statistics, Complex Functions, Principles of Food Engineering

IV、Teaching objective：

The purpose of this course is to enable doctoral students to describe objective relationships in related sciences such as physics, chemistry, physical chemistry, and chemical physics in the course of food science and engineering research in mathematical language (relational expressions). By establishing mathematical models to fully excavate the universal laws in experimental data, scientifically derive or deduce unknown results, and provide necessary solutions and means for discovering new potential laws in scientific research.

Through the study of this course, the foundation enriched for future scientific research in food science and engineering, as well as the development of new processing methods and the invention of new processing techniques.

V、Teaching methods

Integrated teaching (teacher PPT teaching + case teaching + PBL teaching + student group discussion)

VI、Course content, class hour distribution and requirements for students：

■ **Chapter 1 introduction**

1. Teaching content

(1) The status of Mathematical Modeling in the food science and engineering professional curriculum, and the significance of learning the course;

(2) Understand the problem solutions and main solutions solved by mathematical modeling;

(3) Acquisition and pre-processing of experimental data;

(4) The source and control of errors.

2. Basic requirements

Understand the significance of learning this course, understand the role of Mathematical Modeling in exploring the regular mathematical expression methods in food science and engineering, master the main solutions and methods for learning this course and increase the understanding of errors, and initially grasp the analysis methods of errors and the transmission laws of errors. Expand the scientific thinking of doctoral students in food science and engineering.

- **Chapter 2 Introducing the common mathematical models**

1. Teaching content

(1) The selection of model variables;

(2) Model feature extraction;

(3) Principal component analysis and partial least squares model were established;

(4) The establishment of support vector machine model.

2. Basic requirements

Through the simple experience of modeling process by using elementary mathematical scheme, doctors of food science and engineering can master the methods of data induction, statistics and analysis in scientific research by using elementary mathematical methods, and solve some approximate solutions of discrete data with unclear regularity. The establishment methods of principal component analysis, partial least squares model and support vector machine model are introduced.

- **Chapter 3 Establishment of pattern recognition and visualization model**

1. Teaching content

(1) Overview;

(2) Cluster analysis, linear discriminant analysis, quantitative analysis.

(3) The establishment of pattern recognition model;

(4) The establishment of visualization model;

(5) Application of the model in food detection.

2. Basic requirements

Food science and engineering need to solve the problem is to intuitively distinguish the complex detection results in the processing and circulation links. The establishment methods of various models introduced in this chapter are set up to achieve the above purpose. This paper focuses on the establishment of pattern recognition model and visualization model, as well as the application of the model in food detection.

- **Chapter 4 Establishment of multi-sensor information fusion model**

1. Teaching content

(1) The principle of multi-sensor information fusion is introduced;

(2) The modeling method of neural network;

(3) An example of fusion detection system is given;

(4) The prediction model of spectral analysis technology was established.

2. Basic requirements

This chapter mainly introduces the use of information fusion method to establish a model, through the study of a given task and can get a variety of information resources, effective organization and use of multi-source information. Students need to master the principle and application method of information fusion in multi-sensor fusion model, and deduce more available information through data combination.

■ **Chapter 5 Introduction of common statistical methods and analysis software**

1. Teaching content

(1) Brief introduction of chemometrics methods;

(2) The accuracy, stability and applicability of the model are evaluated;

(3) Origin software system;

(4) SPSS software.

2. Basic requirements

Understand the basic process of the birth and development of chemometrics, understand the problems of chemometrics research and solution, master the most basic mathematical processing methods in chemometrics, understand the evaluation methods of accuracy, stability and applicability of mathematical models and the selection principles of optimal models. This paper introduces the popular software system of data processing and establishing mathematical model, which provides necessary mathematical tools for establishing and solving mathematical model and lays a foundation for the practicability of the model.

Chapter	Lecture	Experiment	Operation
Chapter 1 Introduction	3		
Chapter 2 Introducing the common mathematical models	3		
Chapter 3 Establishment of pattern recognition and visualization model	3		
Chapter 4 Establishment of multi-sensor information fusion model	3		
Chapter 5 Introduction of common statistical methods and analysis software	3		
Chapter 6 Student presentations	12	9	
Total Hours	27	9	

VII、Teaching material, main Reference books and Other reference materials for students：

Teaching material：No

Reference books： Jiang Qiyuan, et al. Chief editor. Mathematical model (Fourth Edition), Beijing: Higher

Education Press, 2015.

Chen Guangting, Qiu zheyong, mathematical modeling, higher education press, 2000.

Mark M. meerschert, mathematical modeling (Fourth Edition), 2015.

Other reference materials：No

VII、Lecture(s)：

Wang Chengquan

IX、Responsible for syllabus design：Wang Chengquan

课程介绍：食品科学与技术专题

课程名称：食品科学与技术专题

学分：3

学时：48

课程提纲：

食品科学与技术专题包括四个方面：食品物理加工技术与装备、无损检测技术与装备、食品营养与安全和食品生物工程与装备。本课程的主要内容是让学生了解食品科学与技术领域的主要研究进展，特别是四个主要研究方向（即食品物理加工技术与装备、快速无损检测技术与装备、食品营养与安全和食品生物工程与装备）的发展进程和研究现状。通过上述研究，使学生掌握理论基础，为相关领域的科研、技术和新产品开发工作提供基本的技术方法。

通过本课程的学习，学生应接受以下基本知识和能力训练：

1. 通过对本课程的学习，博士生可以充分了解该学科领域的核心科学技术，并对该学科的内涵有深刻的理解。拓展科学视野，提高整体素质。
2. 把握四个主要方向的科学基础、技术原理、技术手段和发展趋势，便于后续的研究课题和研究工作。
3. 通过对博士研究生的培养，为今后的食品科学研究奠定理论基础和提供基本的技术方法。
4. 使学生具备开发和应用食品加工技术以及分析和解决食品开发中其他具体问题的能力。

Introduction of the Course: Special theme on food science and technology

Course Name：Special theme on food science and technology

Credit：3

Teaching hours：48

Contents of the Syllabus：

Special theme on food science and technology includes four aspects: food physical processing technology and equipment, food non-destructive testing technology and equipment, food nutrition and safety, and food biotechnology and equipment. The main contents of the course is to make the students understand the main research progress in the field of food science and technology, especially on the development course and the present situation of the four main research directions: food physical processing technology and equipment, rapid nondestructive

testing technology and equipment, food nutrition and safety food, and biological technology and equipment. And with these studies, to make students master the theoretical basis and provide basic technical methods for the related fields of scientific research, technology and new product development work.

Through the study of this course, students should receive the following basic knowledge and ability training:

1. Through the study of this course, the doctoral student can fully understand the core science and technology in the field of the subject and have a deep understanding of the connotation of the subject. Expand the scientific field of vision and improve the overall quality.

2. Grasping the scientific basis, technological principles, technological means and development trend of four main directions, and facilitate the subsequent research topics and research work.

3. By the training of doctoral graduate students, to lay a theoretical foundation and provide basic technical methods in the future of food science research.

4. To enable students to have the ability to develop and apply food processing technology and to analyze and solve other specific problems in food development.

课程名称：食品科学技术专题

课程代码：EB083200C1801

I、预计教学时长： 48（实验:__ 学时） **学分：** 3； **课程类型：** 核心专业课；

开课学期： 秋季 semester； **考核方式：** 活动报告/口头汇报/实验；

开课单位： 食品与生物工程学院

II、适用学科和专业学位类别：

食品科学与工程博士生

III、先修课程：

现代食品检测技术、食品加工机械和设备

IV、教学目标：

本课程的主要内容是让学生了解食品科学与技术领域的主要研究进展。食品科学技术专题包括五个方面：食品无损检测技术与设备、食品物理加工技术与设备、食品营养与安全、食品生物安全、食品生物工程与食品智能装备。本课程的主要内容是让学生了解食品科学技术领域的主要研究进展，特别是食品物理加工技术与设备、快速无损检测技术与设备，食品营养与食品安全、生物技术与设备等四个主要研究方向

的发展历程和现状，通过上述学习，使学生掌握理论基础，为相关领域的科学研究、技术和新产品开发工作提供基本的技术方法。

V、教学方法

食品物理加工技术和设备包括超声波、电磁场、微波、激光、高压等物理方法。无损检测技术和设备是指以声、光、电、磁等各种性质为基础，在不破坏主体初始物理和化学性质的前提下进行检测的方法和仪器。食品营养与安全的主要内容包括食品营养和安全指标研究进展、影响人类健康的营养与安全指标、食品加工控制技术。食品生物技术与设备的主要内容包括微生物工程、酶工程、细胞工程、基因工程、蛋白质工程和农产品采后病害生物防治的研究进展和在食品工业中的应用。食品营养与安全的主要内容包括食品营养、营养安全指标、影响人类健康的安全指标和食品加工控制技术的研究进展。食品生物技术与设备的主要内容包括微生物工程、酶工程、细胞工程、基因工程、蛋白质工程和农产品采后病害生物防治的研究进展和在食品工业中的应用。

The main content of food nutrition and safety includes research progress of food nutrition and safety indicators of nutrition and safety indicators affecting human health, and food processing control technology.

VI、课程内容、课时分配和学生要求：

第一章 食品物理加工技术与装备 （10 学时）

1．食品超声加工技术与设备研究进展
2．食品电磁场加工技术与设备研究进展
3．食品红外加工技术与设备研究进展
4．食品物理诱变技术与设备研究进展
5．食品超高压加工技术及设备研究进展
6．食品微波加工技术与设备进展

第二章 食品快速无损检测技术与装备（10 学时）

1. 基于光声能量基本特性的无损检测技术与装备研究进展
2. 电磁、射线探测技术及装备研究进展
3. 视觉信息检测技术及装备研究进展
4. 嗅觉味觉信息检测技术及装备研究进展
5. 新型传感技术及设备研究进展
6. 多信息融合检测技术及设备研究进展

第三章 食品营养与安全 (8 学时)

1. 食品营养与安全概述
2. 食品营养和人类健康研究进展
3. 食源性疾病与食品安全控制进展
4. 食品加工与食品营养安全研究进展

第四章 食品生物安全 (12 学时)

1. 食品生物安全概述
2. 食品微生物安全研究进展
3. 食源性病原体与食品安全

第五章 食品生物技术及设备 (8 学时)

1. 生物技术的基本组成及国内外研究进展
2. 微生物工程在食品行业中的应用进展
3. 食品行业中酶工程、细胞工程、基因工程和蛋白质工程的研究进展
4. 农产品采后病害生物防治研究进展

VII、教材、主要参考书籍和其它参考资料：

本课程没有固定的书籍，主要指相关领域的国际权威学术期刊。

教材：

参考书籍：

其它参考资料：

Science，Nature，Annual Review of Food Science and Technology，Trends In Food Science & Technology，Food Chemistry，Food and Bioprocess Technology，Journal of Agricultural and Food Chemistry，Food Research International，Food Engineering Reviews，Food Quality and Preference，Journal of Sensory Studies, Journal of Food Engineering，Food Reviews International，Food Analytical Methods，Annual Review of Food Science and Technology，Comprehensive Reviews in Food Science and Food Safety，Food Chemistry, et al.

VII、 讲授者：

邹小波, 马海乐, 张红印, 徐斌, 高瑞昌, 石吉勇, 郭志明,崔海英, 王云

IX、教学大纲设计：

邹小波

Course name: Special theme on food science and technology

Course code：EB083200C1801

I、Scheduled Teaching hours： 48（experiments: hours） **credits：** 3 ； **Course type：** **Core Professional Course** ；

Opening semester： **Autumn** semester； **Assessment method：** activity report/Oral quiz/ Experiment ；

Opening unit： **School of Food and Biological Engineering**

II、Applicable disciplines and professional degree categories：

Ph.D. candidate of Food Science and Engineering

III、Prerequisite course：

Modern food testing technology, Food processing machinery and equipment

IV、Teaching objective：

The main contents of the course are to make the students understand the main research progress in the field of food science and technology. Special theme on food science and technology includes five aspects: food non-destructive testing technology and equipment, food physical processing technology and equipment, food nutrition and safety, food biosafety, and food bioengineering and intelligent equipment food. The main contents of the course are to make the students understand the main research progress in the field of food science and technology, especially on the development course and the present situation of the four main research directions: food physical processing technology and equipment, rapid nondestructive testing technology and equipment, food nutrition and safety food, and biological technology and equipment. And with these studies, to make students master the theoretical basis and provide basic technical methods for the related fields of scientific research, technology and new product development work.

V、Teaching methods

Food physical processing technology and equipments includes ultrasonic, electromagnetic field, microwave, laser, high pressure and other physical methods. Nondestructive testing technology and equipment refers to testing of the original premise of subject physical and chemical properties without the destruction, which is based on various properties of sound, light, electricity, magnetic etc. The main content of food nutrition and safety includes research progress of food nutrition and safety indicators of nutrition and safety indicators affecting human health, and food processing control technology. The main content of food biotechnology and equipments includes the research progress and application in food industry of microbial engineering, enzyme engineering, cell engineering, gene engineering, protein engineering, and biological control of postharvest diseases of agricultural products.

VI、Course content, class hour distribution and requirements for students：

Chapter 1 Food physical processing technology and equipments （10 credit hours）

1．Progress on food ultrasonic processing technology and equipment
2．Progress on food electromagnetic field processing technology and equipment
3．Progress on food infrared processing technology and equipment
4．Progress on food physical mutagenesis technology and equipment
5．Progress on food ultra-high pressure processing technology and equipment
6．Progress on food microwave processing technology and equipment

Chapter 2 Food fast nondestructive testing technology and equipments （10 credit hours）

1. Progress on nondestructive testing technology and equipments based on the basic characteristics of photoacoustic power

2. Progress on electromagnetic and ray detection technology and equipments

3. Progress on visual information detection technology and equipment

4. Progress on olfactory sense taste information detection technology and equipments

5. Progress on new sensing technology and equipments

6. Progress on multi information fusion detection technology and equipments

Chapter 3 Food nutrition and safety (8 credit hours)

1. Summary of food nutrition and safety

2. Progress on food nutrition and human health

3. Progress on food borne diseases and food safety control

4. Progress on food processing and food nutrition and safety

Chapter4 Food biosafety (12 credit hours)

1. Summary of Food biosafety

2. Progress on Food microbiological safety

3. Foodborne Pathogens and Food Safety

Chapter5 Food biotechnology and equipments (8 credit hours)

1. Basic composition of biotechnology and research progress at home and abroad

2. Progress on application of microbiological engineering in the food industry

3. Progress on enzyme engineering, cell engineering, gene engineering and protein engineering in the food industry

4. Progress on biological control of postharvest diseases of agricultural products

VII、Teaching material, main Reference books and Other reference materials for students：

There is no fixed book for this course, but it mainly refers to international authoritative academic journals in related fields.

Teaching material：

Reference books：

Other reference materials：

Science，Nature，Annual Review of Food Science and Technology，Trends In Food Science & Technology，Food Chemistry，Food and Bioprocess Technology，Journal of Agricultural and Food Chemistry，Food Research International，Food Engineering Reviews，Food Quality and Preference，Journal of Sensory Studies, Journal of Food Engineering，Food Reviews International，Food Analytical Methods，Annual Review of Food Science and Technology，Comprehensive Reviews in Food Science and Food Safety，Food Chemistry, et al.

VII、Lecture(s)：

Zou Xiaobo, Ma Haile, Zhang Hongyin, Xu Bin, Gao Ruichang, Shi Jiyong, Guo Zhiming, Cui Haiying, Wang Yun

IX、Responsible for syllabus design：

Zou Xiaobo

课程简介:现代食品化学

课程名称: 现代食品化学

学分:2

教学学时:32

教学大纲内容:

现代食品化学是食品科学与工程专业基础课的核心内容。主要内容按食材的主要成分分为引言、水、碳水化合物、脂类、肽与蛋白质、维生素、色素、风味等 8 章。本课程的目标是:(1) 介绍食品原料中主要成分的定义、结构、性质和功能; (2) 揭示这些成分之间的相互作用及其在食品加工和储存过程中的变化; (3) 展示这些反应和变化对食品质量的影响。本课程强调了食品成分与食品质量的关系,为从事食品加工、保鲜和新产品开发的学生提供广泛的理论基础。

Introduction of the Course: Modern Food Chemistry

Course Name： Modern Food Chemistry

Credit：2

Teaching hours：32

Contents of the Syllabus：

Modern Food Chemistry is a core of professional basic courses for food science and engineering major. The main contents are divided into 8 chapters by the main components in food materials including introduction, water, carbohydrate, lipid, peptide and protein, vitamin, pigment, and flavor. The objectives of this course are to (1) introduce the definition, structure, properties and functions of the main components in food materials, (2) reveal the interactions between these components and changes of these components during food processing and storage, and (3) represent the effects of these reactions and changes on food quality. This course highlights the relationship between food component and food quality, which provides a broad theoretical basis for students who engage in the food processing, preservation and new product development.

课程名称：现代食品化学

课程代码：EB083200D1801

I、计划学时： 32 （实验 0 学时）； **学分：** 2 ； **课程类型：** 专业选修课 ； **开课学期：** 春 学期； **授课方式：** 报告 **开课学院：** 食品与生物工程学院

II、适用的学科及专业学位类别（领域）：

食品科学与工程博士

III、预修课程

生物化学、有机化学

IV、教学目的：

本课程的目标是：(1)介绍食品原料中主要成分的定义、结构、性质和功能；(2)揭示这些成分之间的相互作用及其在食品加工和储存过程中的变化；(3)展示这些反应和变化对食品质量的影响。本课程强调了食品成分与食品质量的关系，为从事食品加工、保鲜和新产品开发的学生提供广泛的理论基础。

V、教学方法

1. 多媒体网络教学
2. 课程考核包括 2 部分：10%课堂考核+90%报告作业

VI、课程内容，学时分配和学生要求：

第一章　绪论　（2 学时）

1．食品化学的范畴和发展历史
2．食品化学的研究内容
3．化学变化对食品品质、营养和安全的影响研究

第二章　水　（2 学时）

1．水对食品加工和贮藏的影响
2．水与干燥技术

第三章　碳水化合物　（6 学时）

1．基本概念、种类和功用
2．单糖与多糖的结构、性质
3．非蔗糖甜味剂介绍

第四章　脂类　（6 学时）

1. 脂类的结构与命名
2. 脂类的物理性质
3. 脂类的氧化和热分解
4. 脂类与食品可塑性及风味

第五章　肽和蛋白质　（6 学时）

1．蛋白质的种类
2. 蛋白质的结构和性质
3．蛋白质酶解和肽的分离纯化技术

第六章　维生素　（2 学时）

1．维生素的结构和分类
2．维生素的人体需要特点
3．维生素在食品加工贮藏中的变化

第七章　色素　（4 学时）

1. 色素的分类、结构、性质
2. 色素的营养性和毒性
3. 色素的标准以及限量

第八章　风味物质　　（4 学时）

1．食品中风味物质的分类与性质

2．风味物质的检测技术

VII、教材、主要参考书及其他供学生参考的资料：

主要参考书：1. Owen R. Fennema. Food Chemistry. New York, Marcel Dekker, Inc., 1996；

其他参考资料：2. Belitz, H. D., Grosch, W. Food Chemistry. New Yolk: Springer verlag, Berlin Heidelberg, 1999

VII、任课教师（小组）： 曲文娟，周晨光，郑开逸

IX、课程大纲设计人：曲文娟

Course name: Modern Food Chemistry

Course code: EB083200D1801

I、Scheduled Teaching hours：32（experiments: 0 hours） **credits：2**； **Course type：directional selective course ；**

Opening semester：Spring semester； **Assessment method：activity report** ；

Opening unit：Food and biological engineering school

II、Applicable disciplines and professional degree categories：

Food science and engineering Doctor

III、Prerequisite course：

Biological chemistry, Organic chemistry

IV、Teaching objective：

The objectives of this course are to (1) introduce the definition, structure, properties and functions of the main components in food materials, (2) reveal the interactions between these components and changes of these components during food processing and storage, and (3) represent the effects of these reactions and changes on food quality. This course highlights the relationship between food component and food quality, which provides a broad theoretical basis for students who engage in the food processing, preservation and new product development.

V、Teaching methods

1. Multimedia teaching and network teaching

2. The examination of the course includes two parts: 10% classroom performance and 90% activity report

VI、Course content, class hour distribution and requirements for students：

Chapter1　Introduction　　（2 hours）

1. Scope and development history of food chemistry

2. Research content of food chemistry

3. Effect of chemistry changes on food quality, nutrition, and safety

Chapter2　Water　　（2 hours）

1. Effects of water on food processing and storage
2. Water and drying technology

Chapter3 Carbohydrates （6 hours）

1. Basic concepts, categories and functions
2. Structure and properties of monosaccharides and polysaccharides
3. Introduction to non-sugar sweeteners

Chapter4 Lipids （6 hours）

1．Structure and nomenclature of lipids
2．The physical properties of lipids
3．Oxidation and thermal decomposition of lipids
4．Food plasticity and flavor

Chapter5 Peptides and proteins （6 hours）

1. Types of proteins
2. Structure and properties of proteins
3. Enzymatic hydrolysis of proteins and separation and purification of peptides

Chapter6 Vitamins （2 hours）

1. The structure and classification of vitamins
2. The characteristics of the human needs of vitamins
3. Changes of vitamins in food processing and storage

Chapter7 Pigments （4 hours）

1. Classification, structures and properties of pigments
2. Nutritional and toxic effects of pigments
3. Regulation and control of pigment in foods

Chapter8 Flavors （4 hours）

1. Classification and properties of flavor substances in food
2. Detection of flavor substances

VII、Teaching material, main Reference books and Other reference materials for students：

Reference books： 1. Owen R. Fennema. Food Chemistry. New York, Marcel Dekker, Inc., 1996；

Other reference materials： 1. Belitz, H. D., Grosch, W. Food Chemistry. New Yolk: Springer verlag, Berlin Heidelberg, 1999

VII、Lecture(s)： Qu Wenjuan, Zhou Chenguang, Zheng Kaiyi

IX、Responsible for syllabus design： Qu Wenjuan

课程介绍：食品科学技术前沿进展

课程名称：食品科学技术前沿进展

学分：2

学时：32

课程提纲：

食品产业是民生产业，是国民经济的重要支柱产业。食品工业的可持续、稳定发展有赖于以食品科学前沿研究成果为基础的食品科技的持续进步。本课程特邀国内外知名专家和领军人物举办学术专题讲座，开展前沿研究讨论，了解国内外的研究趋势和进展，引导学者对未来的研究方向提出建议。通过学习本课程，使学生了解国内外食品科学技术领域的主要研究进展，特别是学校食品科学与工程学科五大研究方向（即农产品无损检测技术及智能装备、食品物理加工技术与智能装备、食品营养与健康、食品安全和食品生物工程与智能装备）的发展和研究现状，从而为相关科学研究、学科技术发展和新产品开发工作奠定理论基础，提供基本的技术方法。

Introduction of the Course: Advances in Food Science and Technology

Course Name：Advances in Food Science and Technology

Credit：2

Teaching hours：32

Contents of the Syllabus：

The food industry is the livelihood industry, is the national economy important pillar industry. The sustainable and stable development of food industry depends on the continuous progress of food technology, which is based on the cutting-edge research results of food science. Renowned experts and leaders from home and abroad in the field of food will be specially invited to give lectures in the form of academic lectures on special topics, carry out cutting-edge research discussions, understand the research trends and progress at home and abroad, and guide academics to put forward suggestions on future research directions. Through learning this course, make students understand the main research progress in the field of food science and technology at home and abroad and the development trend, especially the school food science and engineering discipline of the five main research direction of nondestructive testing technology and intelligent agricultural food physical equipment, food processing technology and equipment, food nutrition and health, food safety, food, biological engineering and the development and research status of

intelligent equipment, for the relevant scientific research, technological development in the discipline and new product development work to lay the theoretical foundation and provide basic technical method.

课程名称: 食品科学技术前沿进展

课程代码：EB083200D1814

I、预计教学时长： 32（实验: 学时） **学分：** 2； **课程类型：** 核心专业课；

开课学期： 秋季 学期； **考核方式：** 活动报告/口头汇报/实验；

开课单位： 食品与生物工程学院

II、适用学科和专业学位类别：

食品科学与工程

III、先修课程：

现代食品检测技术、食品加工机械和设备

IV、教学目标：

食品产业是我国重要的民生产业，是国民经济的重要支柱产业。食品行业的可持续稳定发展有赖于食品技术的不断进步，而食品技术是基于食品科学的前沿研究成果。本课程将特邀国内外食品领域知名专家和领军人物以专题学术讲座的形式开展前沿研究讨论，了解国内外研究动态和进展，引导学者对未来研究方向提出建议。通过学习本课程，使学生了解国内外食品科学技术领域的主要研究进展和发展趋势，特别是学校食品科学与工程学科的五大研究方向（食品农产品无损检测技术和智能装备，食品物理加工技术与智能设备、食品营养与健康、食品安全、食品生物工程和智能设备）的发展和研究现状，从而为相关学科的科学研究、技术开发和新产品开发工作奠定理论基础、提供基本技术方法。

V、教学方法

重点讲解食品各研究方向的前沿进展和发展趋势，以专题讲座形式开展互动教学。

VI、课程内容、课时分配和学生要求：

第一章 食品科学技术的基本概念及国内外发展趋势 (2 学时)

第二章 食品贮藏保鲜前沿技术 (2 学时)

第三章 农产品采后病害生物防治前沿进展 (4 学时)

第四章 食品物理加工技术进展 (4 学时)

第五章 食品分离和提取技术进展 (2 学时)

第六章 功能食品研究前沿进展 (4 学时)

第七章 食品快速无损检测的概念及方法 (2 学时)

第八章 食品快速无损检测技术前沿进展 (4 学时)

第九章 食品快速无损检测设备前沿进展 (4 学时)

第十章 食品营养成分研究进展 (4 学时)

第十一章 益生菌及其应用技术进展 (2 学时)

第十二章 食品安全控制进展 (2 学时)

VII、教材、主要参考书籍和其它参考资料：

本课程没有固定的书籍，主要指相关领域的国际权威学术期刊。

教材：

参考书籍：

其它参考资料：

Science，Nature，Annual Review of Food Science and Technology，Trends In Food Science & Technology，Food Chemistry，Food and Bioprocess Technology，Journal of Agricultural and Food Chemistry，Food Research International，Food Engineering Reviews，Food Quality and Preference，Journal of Sensory Studies, Journal of Food Engineering，Food Reviews International，Food Analytical Methods，Annual Review of Food Science and Technology，Comprehensive Reviews in Food Science and Food Safety，Food Chemistry, et al.

VII、讲授者：

邹小波，等

IX、教学大纲设计：

邹小波

Course name: Advances in Food Science and Technology

Course code：EB083200D1814

I、Scheduled Teaching hours： 32 （experiments: __ hours） **credits：** 2 ； **Course type：** **Core Professional Course** ；

Opening semester： **Autumn** semester； **Assessment method：** activity report/Oral quiz/ Experiment ；

Opening unit：School of Food and Biological Engineering

II、Applicable disciplines and professional degree categories：

Food Science and Engineering

III、Prerequisite course：

Modern food testing technology, Food processing machinery and equipment

IV、Teaching objective：

The food industry is the livelihood industry, is the national economy important pillar industry. The sustainable and stable development of food industry depends on the continuous progress of food technology, which is based on the cutting-edge research results of food science. Renowned experts and leaders from home and abroad in the field of food will be specially invited to give lectures in the form of academic lectures on special topics, carry out cutting-edge research discussions, understand the research trends and progress at home and abroad, and guide academics to put forward suggestions on future research directions. Through learning this course, make students understand the main research progress in the field of food science and technology at home and abroad and the development trend, especially the school food science and engineering discipline of the five main research direction of nondestructive testing technology and intelligent agricultural food physical equipment, food processing technology and equipment, food nutrition and health, food safety, food, biological engineering and the development and research status of intelligent equipment, for the relevant scientific research, technological development in the discipline and new product development work to lay the theoretical foundation and provide basic technical method.

V、Teaching methods

Focus on explaining the frontier trends and development trends of various research directions of food, and carry out interactive teaching in the form of special lectures.

VI、Course content, class hour distribution and requirements for students：

Chapter 1 Basic Concepts of Food Science and Technology and Development Trends at home and abroad (2 hours)

Chapter 2 Frontiers of Food Storage and Preservation Technology (2 hours)

Chapter 3 Frontiers of Biological control of Postharvest Diseases of Agricultural Products (4 hours)

Chapter 4 Advances in Food Physical Processing Technology (4 hours)

Chapter 5 Advances in food Separation and Extraction Technology (2 hours)

Chapter 6 Advances in the Frontier of Functional Food (4 hours)

Chapter 7 Concepts and Methods of Rapid Nondestructive Testing of Food (2 hours)

Chapter 8 The frontier of rapid Nondestructive Testing technology for Food (4 hours)

Chapter 9 Frontier of Rapid Nondestructive Testing equipment for Food (4 hours)

Chapter 10 Research Progress of Food Nutrients (4 hours)

Chapter 11 Advances in Probiotics and Applied Technologies (2 hours)

Chapter 12 Progress of Food Safety Control in Lecture 12 (2 hours)

VII、Teaching material, main Reference books and Other reference materials for students：

There is no fixed book for this course, but it mainly refers to international authoritative academic journals in related fields.

Teaching material：

Reference books：

Other reference materials：

Science，Nature，Annual Review of Food Science and Technology，Trends In Food Science & Technology，Food Chemistry，Food and Bioprocess Technology，Journal of Agricultural and Food Chemistry，Food Research International，Food Engineering Reviews，Food Quality and Preference，Journal of Sensory Studies, Journal of Food Engineering，Food Reviews International，Food Analytical Methods，Annual Review of Food Science and Technology，Comprehensive Reviews in Food Science and Food Safety，Food Chemistry, et al.

VII、Lecture(s)：

Zou Xiaobo, et.al

IX、Responsible for syllabus design：

Zou Xiaobo

课程介绍：实验室操作安全规范及技能

课程名称： 实验室操作安全规范及技能

学　　分：2

学　　时：32

课程内容：

实验室操作安全规范及技能是学生进入实验室前的必修课。

首先通过案例分析提升学生的安全意识，让学生了解和认识到实验室安全的重要性和必要性，牢固树立“生命至上”的安全理念。进一步讲授安全相关知识及基本操作技能，确保每个学生掌握涉及到自己实验的全部安全操作知识和技能。

通过实践操作和理论讲授，使学生具备基本的安全知识和操作技能。熟悉实验室安全规章制度，形成遵守规章制度的意识。掌握基本的救护知识，掌握面对实验室突发事件的应急处理能力。

主要内容包括实验室基本安全知识，用水用电安全知识，化学品危险性及管理知识，生物实验室分类及安全管理知识，实验室风险评估基本知识。

熟悉实验室常见的消防设施及其使用方法，熟悉实验室防护知识，形成安全防护意识。实验室废弃物分类处理知识。

Introduction of the Course: Laboratory standard operating procedures and skills

Course Name： Laboratory standard operating procedures and skills

Credit：2

Teaching hours：32

Contents of the Syllabus：

Laboratory standard operating procedures and skills is an obligatory course for students who want to work in a lab. Through case studies of various kinds of lab safety issues, students will get to know and realize the importance and necessity of lab safety, and raise their awareness of lab safety, make sure they know the principle that human life is of the greatest importance when working in the lab. The course will further teach the students about the knowledge related to lab safety, as well as the basic operating skills to achieve this goal. The course ensures every student will master the all the knowledge and skills related to lab safety, especially in his or her own field. Through theoretical lectures and hands-on experiment, students will have basic knowledge about safety and operating skills, be familiar with lab safety rules and obey the rules. Students will learn the basic knowledge and skills about first-aid, and learn how to properly deal with the emergency in a lab.

The main content includes basic knowledge about lab safety, safety related to water usage, safety related to

electricity usage, dangerous effect and exposure risk of chemicals and management, classification of bio labs and safety management, basic knowledge about risk assessment of lab. Students will be familiar with the use of fire extinguisher, know the protection measures needed in the lab, raise safety awareness and know how to deal with lab waste.

课程名称: 实验室操作安全规范及技能

课程代码：EB083200D1813

一、计划学时：32（其中实验 14 学时）；　**学分：2**；　**课程性质：必修课**；

开课学期：第 I 学期；　**考核方式：**闭卷笔试+实验；

开课单位：食品与生物工程学院

二、适用的学科及专业学位类别：

适用食品科学与工程学科硕士研究生，也适用于其他学科专业和专业学位类别（领域）。

三、预修课程：

无

四、教学目的：

通过本课程的理论教学和训练及研讨，使学生具备下列知识、能力和素质。

1.知识方面：（1）实验室安全防护基础知识；（2）消防安全基础知识；（3）水电安全基础知识；（4）化学品危害及分类；（5）化学品管理及存放；（6）实验室常见化学试剂危险性及应急处理办法；（7）实验室生物安全基本知识；（8）实验室消毒与灭菌；（9）病原微生物实验室管理；（10）基因工程潜在生物危害与评估；（11）生物实验室突发事件的预防与应急处理

2.能力与素质方面：（1）提升安全意识、规范意识和防护意识；（2）提升对于突发事件的应急处理能力；（3）对于安全风险的评估能力；（4）实验室安全操作的基本技能。具备保护自己和他人身体健康和生命安全的知识和技能。树立起对敬畏生命、勇于担当社会主义价值观。

五、教学方式

课堂讲授、实际操作，案例分析与讨论，视频

六、课程内容、学时分配及对学生的要求：

第一章　绪论　　(3 学时)

1. 实验室安全问题的由来与重要性

2. 学习本课程的目的

3. 课程的主要内容

4. 典型案例分析与研讨：安全问题案例分析

第二章 一般安全 **（3 学时）**

1. 突发事件紧急联系方式

2. 校保卫部、校医院

3. 认识实验室的各种安全标签、信息牌

4. 实验室的物品摆放

5. 熟悉实验室环境

6. 实验室的禁止、注意事项

7. 进入实验室前的个人防护

8. 实验结束后的步骤

9. 实验室紧急救护知识

第三章 消防安全 **（2 学时）**

1. 消防相关标识的认识

2. 实验室常见火灾隐患

3. 实验室防火自救的基本常识

第四章 水电安全 **（3 学时）**

1. 用电安全基础知识和简单电工操作

2. 触电救援方法

3. 常见用水安全

4. 加热设备使用安全

5. 高速运转设备使用安全

第五章 化学品危害、分类和标志 **（2 学时）**

1. 化学品危险性鉴别及分类

2. 危险化学品标签识别系统简介

3. 危险化学品的实验室防护措施

第六章 化学品管理、存放 **（2 学时）**

1. 危险化学品的管理及使用

2. 主要有机试剂的存放及使用

3. 无机酸碱的分类、存放及使用

第七章 实验室常用化学试剂危险性及应急处理办法 **（4 学时）**

1. 酸碱泼洒应急处理

2. 腐蚀性伤害应急处理

3. 气体泄漏应急处理

4. 其他以及处理

第八章　生物安全实验室防护和技术　　（4 学时）

1. 生物安全实验等级分类

2. 个人防护装备

3. 常见危险及防护

第九章 生物安全实验室的主要设备及操作　　（4 学时）

1. 生物安全柜

2. 高压灭菌器

3. 其他设施及操作

第十章 基因工程潜在生物危害和评估　　（3 学时）

1. 实验室重组 DNA 试验隐含的生物危害

2. 基因工程产品使用的潜在危害

3. 基因编辑/治疗的生物危害

第十一章 生物安全突发事件预防及应急处理　　（2 学时）

1. 实验室突发事件的预防

2. 实验室突发事件应急处置

七、教材、主要参考书目及学生必读参考资料：

参考书目：National Research Council. (2011). Prudent practices in the laboratory: handling and management of chemical hazards, updated version.

八、任课教师（小组）：

包玉龙，胡新娟，赵一鸣

九、大纲撰写人：

包玉龙，胡新娟，赵一鸣

Course name: Laboratory standard operating procedures and skills

Course code：EB083200D1813

I、Scheduled Teaching hours：32（experiments: 14 hours） **credits：2**； **Course type：obligatory**；

Opening semester： **Autumn** semester； **Assessment method：** Open book written test / Experiment ；

Opening unit： **School of Food and Biological Engineering**

II、Applicable disciplines and professional degree categories：

Master students in the major of food science and engineering, and also other related areas.

III、Prerequisite course：

None

IV、Teaching objective：

Through lectures and hands-on experiment, students will learn the following knowledge and skill:

1. Knowledge: 1) basic protection in lab; 2)fire extinguish; 3)water/electricity safety; 4)hazards of chemicals and classification; 5) storage and management of chemicals; 6) dangerous effect of common chemicals and emergency dealing methods; 7)basic knowledge about biosafety; 8) disinfection and sterilization;9)pathogen management; 10) risk assessment of gene engineering; 11)Prevent the emergency in biolab and dealing with emergency.

2. Skill and awareness: 1) raise awareness of safety, rules and protection; 2)learn how to deal with emergency in lab; 3)risk assessment about lab safety; 4)basic skills of safe operation in lab. Students will learn how to protect themselves and others, respect the life and be responsible.

V、Teaching methods

lectures, hands-on experiment, case study, video clips

VI、Course content, class hour distribution and requirements for students：

Chapter 1 Introduction (3 hours)

1. Importance of lab safety

2. The aim of this course

3. main content

4. typical safety issues: case study

Chapter 2 General safety (3 hours)

1. Contact info for emergency- hospital and police in campus

2. Label and other info cards in lab

3. Layout of lab

4. Be familiar with lab environment

5. Cautions and forbidden in lab

6. Personal protection before entering the lab

7. Measures be taken before leaving the lab

8. First-aid knowledge in lab

Chapter 3 Fire safety (2 hours)

1. The labels of fire safety

2. Risk of fire in lab

3. Basic knowledge in dealing with fire in lab

Chapter 4 water/electricity safety (2 hours)

1. Basic knowledge of electricity

2. Deal with electricity leakage

3. Safety of water usage

4. Heating equipment safety

5. High-speed equipment safety

Chapter 5 Risk, classification and label of chemical (3 hours)

1. Dangerous effect of chemical and classification

2. Label of dangerous chemicals

3. Protection measures for dangerous chemicals

Chapter 6 Storage and management of chemicals (2 hours)

1. Management and usage of dangerous chemical

2. Storage and usage of organic reagent

3. Classification, storage and usage of inorganic acids/alkaline

Chapter 7 Risk of common chemicals and emergency dealing (4 hours)

1. Spill of acids/alkaline

2. Corrosive reagent

3. Leakage of gas

4. Other emergency situation

Chapter 8 Safety and protection in bio-lab (4 hours)

1. Classification of bio-labs

2.Personal protection

3. Common risk and dealing methods

Chapter 9 Major equipment in bio-lab and the operation (4 hours)

1. Biological safety cabinet

2. Autoclave

3. Others

Chapter 10 Potential risk and assessment of gene engineering (3 hours)

1. Recombined DNA

2. Risk of use of genetically modified products

3. Gene editing/therapy

Chapter 11 Emergency and measures in biolab (2 hours)

1. Prevent the risk

2. Emergency handling

VII、Teaching material, main Reference books and Other reference materials for students：

Reference books： National Research Council. (2011). Prudent practices in the laboratory: handling and management of chemical hazards, updated version.

VII、Lecture(s)：

Yulong Bao, Xinjuan Hu, Yiming Zhao

IX、Responsible for syllabus design：

Yulong Bao, Xinjuan Hu, Yiming, Zhao

Introduction of the Course: Nondestructive Detection Techniques and Equipments for Food and Agro-Products

课程简介：食品农产品无损检测技术及装备

Course Name： Nondestructive Detection Techniques and Equipments for Food and Agro-Products

课程名称：食品农产品无损检测技术及装备

Credit：2

学分：2

Teaching hours：32

学时：32

Contents of the Syllabus:

课程大纲内容：

This is a specialized elective course for doctoral candidates in the field of food science and engineering. The teaching contents consist of Near Infrared Spectroscopy Technology, Computer Vision Technology, Hyper and Multi-spectral Imaging Technology, Biomimetic Sensor Technology and Biosensor Detection Technology. This course shall describe the principles, methods, characteristics, equipments and applications of each testing method, etc. In the teaching process, blackboard writing, power point presentations, case analysis, experimental teaching and other teaching methods would be adopted comprehensively. After the completion of this course, the student will be able to use the food nondestructive detection techniques in practice. According to the characteristics and background of food science and engineering, the basic knowledge of food nondestructive detection techniques is combined with its practical application in food analysis. Through the study of the theoretical part of this course, students can further deepen their understanding of the basic theory, principles and equipment composition of food nondestructive detection techniques, and get familiar with the basic components and analysis process of analytical instruments and equipments, qualitative and quantitative analysis methods and the main influencing factors. Through case teaching and experimental teaching, the students will be acquainted with the basic operation skills of relevant technologies and have the ability to analyze and solve corresponding technical operations and problems. The study of this course will lay the foundation for future research work involving food analysis and testing. The main objective of this course is to develop students' ability to use nondestructive testing techniques to solve complex food analysis and testing problems. The students shall not only understand the principles, methods, characteristics and applications of each testing method, but also be able to execute the correct selection of a non-destructive testing method/equipment to check and evaluate the quality of food.

本课程是食品科学与工程领域博士研究生的一门专业选修课。教学内容具体包含近红外光谱技术、计算机视觉、高光谱和多光谱成像技术、仿生传感技术和生物传感技术等五个方面。本课程将对多种检测技术的原理、方法、特点、装备和应用进行讲述。在教学过程中，

教师将采用板书、PPT、案例分析以及实验教学相结合的方法，使得学生在完成本课程学习后不仅能够在实践中使用食品无损检测技术及装备，并能够根据食品科学与工程专业的特点和背景，在食品分析中将食品无损检测技术的基础知识与实践应用相结合。通过本课程理论部分的学习，学生可以进一步加深对食品无损检测技术的基本理论、原理和装备组成的理解，熟悉分析仪器和设备的基本组成和分析过程，定性、定量分析的方法以及主要影响因素。通过案例教学和实验教学，学生能够更加熟悉相关技术的基本操作，具有分析和解决相应技术操作问题的能力。本课程的学习能够为未来涉及食品分析和检测研究工作的同学奠定基础。本课程的主要目标是培养学生利用无损检测技术解决复杂食品分析和检测问题的能力。通过本课程的学习，学生不仅能了解每种检测技术/装备的原理、方法、特点及应用，还能为食品质量的快速无损检测选择合适的方法。

Course name: Nondestructive Detection Techniques and Equipments for Food and Agro-Products

Course code：EB083200D1817

课程名称：食品农产品无损检测技术与装备

课程代码：EB083200D1817

Ⅰ、**Scheduled Teaching hours：** 32 （experiments: 6 hours） **credits：** 2 ； **Course type：** Specialized Elective Course；

Opening semester： Autumn semester； **Assessment method：** Essay Report ；

Opening unit： School of Food and Biological Engineering

Ⅰ、**课程总学时：** 32（实验学时：6）**学分：** 2；**课程类型：** 专业选修课；

课程选修学期： 秋季学期；**考核类型：** 论文报告；

开课单位： 食品生物与工程学院

Ⅱ、**Applicable disciplines and professional degree categories：**

Applicable discipline: Food Science and Engineering and its secondary discipline; Degree Category: Engineering Doctorate

Ⅱ、**适用学科和专业学位类别：**

适用学科：食品科学与工程及其二级学科；学位类别：工学博士

Ⅲ、**Prerequisite course：**

Basics of Computer Applications, Electronics in Electrical Engineering, Food Chemistry, etc.

Ⅲ、预修课程：

计算机应用基础、电子工程、食品化学等。

Ⅳ、Teaching objective：

Students will learn how to use non-destructive detection techniques to detect the quality of food and learn some simple principles of non-destructive detection technologies. Students will understand the relevant equipment and composition involved in non-destructive detection techniques. Knowledge gained in this course would expose students to applications and prospects of non-destructive detection techniques in the field of food science and engineering.

Ⅳ、课程目标：

学生将学习如何使用无损检测技术检测食品质量，掌握无损检测技术的基本原理，了解无损检测技术的相关装备和组成。通过本课程的学习，学生可了解无损检测技术在食品科学与工程领域的应用和前景。

Ⅴ、Teaching methods

Blackboard writing/PPT teaching/case analysis/experiment

Ⅴ、教学方法

板书、PPT 教学、案例分析、实验

Ⅵ、Course content, class hour distribution and requirements for students：

Ⅵ、课程内容、课时分配以及课堂要求

Chapter 1 Introduction

（4 credits hours）

1. Concept of non-destructive detection methods and related theories
2. The role and significance of non-destructive testing in food science
3. Applications and characteristics of commonly used nondestructive detection methods

Requirements: Understand the commonness and characteristics of different nondestructive detection methods, as well as the applications and characteristics of commonly used nondestructive detection methods.

第一章 引言 **（4 学时）**

1. 无损检测方法的概念及相关理论
2. 无损检测技术在食品科学中的作用和意义
3. 常用无损检测方法的应用及特点

要求：了解不同无损检测方法的共性和特点，以及常用无损检测方法的应用和特点。

Chapter 2 Principle and Application of Near Infrared Spectroscopy Technology （6 credits hours）

1. Overview of near-infrared spectroscopy technology
2. Instrument and equipment of near infrared spectroscopy
3. Examples of related application

Requirements: Understand the basic instrument and equipment designs in near infrared spectroscopy system; familiar with the main structure, working principle, analysis flow and related application of near infrared spectroscopy.

第二章 近红外检测技术的原理与应用 （6 学时）

1. 近红外光谱技术的概述
2. 近红外光谱仪器和装备
3. 近红外光谱的相关应用

要求：了解近红外光谱系统仪器和装备的组成设计，熟悉近红外光谱系统的主要结构、工作原理、分析流程和相关应用。

Chapter 3 Principle and Application of Computer Vision Technology （4 credits hours）

1. Overview of computer vision technology
2. Components and equipment of computer vision systems
3. Examples of related application

Requirements: Understand the principle of computer vision technology, understand the basic composition and equipment of computer vision system, and be familiar with the characteristics and applications of computer vision technology.

第三章 计算机视觉技术的原理及应用 （4 学时）

1. 计算机视觉的概述
2. 计算机视觉系统组成及装备
3. 计算机视觉的相关应用

要求：了解计算机视觉技术的原理，了解计算机视觉系统的基本组成和设备，熟悉计算机视觉技术的特点和应用。

Chapter 4 Principle and Application of Hyper and Multi-Spectral Imaging Technology

（6 credits hours)

1. Overview of spectral imaging technology
2. The principle of hyperspectral imaging and multi-spectral imaging
3. Equipment of hyperspectral imaging and multi-spectral imaging
4. Examples of related applications of spectral imaging

Requirements: Understand the characteristics of spectral imaging technology; understand the relationship between spectral imaging, spectroscopy and computer vision. Master the basic structure of hyper and multi-spectral imaging systems, the image forming principle, data analysis, processing and modeling method of spectral images. Familiar with their equipments and typical applications in the field of food and agricultural products.

第四章 高光谱和多光谱成像技术的原理及应用 （6 学时）

1. 光谱成像技术的概述
2. 高光谱和多光谱成像原理

3. 高光谱和多光谱成像检测装备

4. 光谱成像技术的相关应用

要求：了解光谱成像技术的特点，以及光谱成像、光谱和计算机视觉之间的关系。掌握高光谱和多光谱成像系统的基本结构，以及高光谱和多光谱成像技术的成像原理、数据分析、处理和建模的方法。熟悉高光谱和多光谱成像技术的设备及其食品农产品领域的典型应用。

Chapter 5　Principle and Application of Biomimetic Sensor Technology　（6 credits hours）

1. Overview of biomimetic sensor technology
2. The principle of electronic nose technology
3. The principle of electronic tongue technology
4. Detection device of electronic nose and electronic tongue technology
5. Examples of related application

Requirements: Understand the principle of biomimetic sensor technology; Understand the system components of electronic nose and electronic tongue technologies; Master the main structure, working principle and analysis process of electronic nose and electronic tongue systems; Familiar with the characteristics and applications of biomimetic sensor analysis.

第五章 仿生传感技术的原理及应用　（6 学时）

1. 仿生传感技术的概述
2. 电子鼻技术的原理
3. 电子舌技术的原理
4. 电子鼻和电子舌技术的检测装置
5. 仿生传感技术的相关应用

要求：了解仿生传感技术的原理；了解电子鼻和电子舌系统的组成，掌握电子鼻和电子舌技术的主要结构、工作原理和分析过程；熟悉仿生传感器的分析特点及应用。掌握仿生传感技术的定性、定量分析方法及性能评价指标。

Chapter 6　Principle and Application of Biosensor Technology　（6 credits hours）

1. The principle of biosensor technology
2. Overview of upconversion fluorescence, Surface enhanced Raman spectroscopy and electrochemical sensor technologies
3. Instrument and Equipment of biosensor technology
4. Related examples of biosensor technology

Requirements: Understand the theoretical principles and applications of the (nano) biosensors. The components, detection mechanisms, and characteristics of various biosensors; Acquaintance with the basic principles of upconversion fluorescence, surface-enhanced Raman spectroscopy and electrochemical sensor technologies. The strategies learned will be implemented in the design of biosensors for food safety and quality evaluation.

第六章　生物传感技术的原理与应用　（6 学时）

1. 生物传感技术的基本原理

2. 上转换荧光、表面增强拉曼光谱和电化学传感技术的概述

3. 生物传感技术的仪器和设备

4. 生物传感技术的相关应用

要求：了解（纳米）生物传感器的理论和应用，了解不同类型生物传感器的组成、检测机理和特征；熟悉上转换荧光、表面增强拉曼光谱和电化学传感技术的基本原理；并将所学的能力应用于食品安全和质量评估的生物传感器设计。

Class Hour Distribution：

Chapters	Teaching hours	Experiments
Chapter 1 Introduction	4	
Chapter 2 Principle and Application of Near Infrared Spectroscopy Technology	4	2
Chapter 3 Principle and Application of Computer Vision Technology	4	
Chapter 4 Principle and Application of Hyper and Multi-Spectral Imaging Technology	4	2
Chapter 5 Principle and Application of Biomimetic sensor Technology	4	2
Chapter 6 Principle and Application of Biosensor Technology	6	
Total	**26**	**6**

课时分配

章节	理论学时	实验学时
第一章 引言	4	
第二章 近红外光谱技术的原理及应用	4	2
第三章 计算机视觉技术的原理及应用	4	
第四章 高光谱和多光谱成像技术的原理及应用	4	2
第五章 仿生传感技术的原理及应用	4	2
第六章 生物传感技术的原理及应用	6	
总计	**26**	**6**

Ⅷ、Teaching material, main Reference books and Other reference materials for students：

Teaching material：

1. Quansheng Chen, Hao Lin, Jiewen Zhao. Advanced Nondestructive Detection Technologies in Food [M]. Springer Singapore, 2021.
2. Xiaobo Zou, Jiewen Zhao. Nondestructive Measurement in Food and Agro-products [M]. Springer Dordrecht, 2015.

Reference books：

1. Bosoon Park, Renfu Lu. Hyperspectral Imaging Technology in Food and Agriculture [M]. Springer New York, 2015.
2. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing (4th Edition) [M]. Pearson, 2018.
3. Emil W. Ciurczak, Benoît Igne, Jerome Workman, Jr., Donald A. Burns. Handbook of Near-Infrared Analysis (4th Edition) [M]. CRC Press, 2021
4. Ping Wang, Qingjun Liu, Chunsheng Wu, K. Jimmy Hsia. Bioinspired Smell and Taste Sensors [M]. Springer Dordrecht, 2015.
5. Yoon, Jeong-Yeol. Introduction to biosensors: from electric circuits to immunosensors. Springer, 2016.

Other reference materials：

Recent academic papers published in related fields.

Recommend a number of authoritative international academic journals (but not limited to these): Science, Nature, Nature Food, Trends in Food Science & Technology, Comprehensive Reviews in Food Science and Food Safety, Annual Review of Food Science and Technology, Critical Reviews in Food Science and Nutrition, Biosensors and Bioelectronics, Journal of Hazardous Materials, Food Chemistry, Sensors and Actuators B: Chemical, Journal of Agricultural and Food Chemistry, Food Control, Food Research International, Journal of Food Engineering, LWT-Food Science and Technology, Journal of Food Composition and Analysis, Food Analytical Methods.

Ⅶ、教材、主要参考书目和其他参考材料

教材：

1. Quansheng Chen, Hao Lin, Jiewen Zhao. Advanced Nondestructive Detection Technologies in Food. Springer Singapore, 2021.
2. Xiaobo Zou, Jiewen Zhao. Nondestructive Measurement in Food and Agro-products. Springer Dordrecht, 2015.

参考书目：

1. Bosoon Park, Renfu Lu. Hyperspectral Imaging Technology in Food and Agriculture. Springer New York, 2015.
2. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing (4th Edition). Pearson, 2018.
3. Emil W. Ciurczak, Benoît Igne, Jerome Workman, Jr., Donald A. Burns. Handbook of Near-Infrared Analysis (4th Edition) [M]. CRC Press, 2021
4. Ping Wang, Qingjun Liu, Chunsheng Wu, K. Jimmy Hsia. Bioinspired Smell and Taste Sensors. Springer Dordrecht, 2015.
5. Yoon, Jeong-Yeol. Introduction to Biosensors: From Electric Circuits to Immunosensors. Springer, 2016.

其它参考材料：

相关领域近期发表的学术论文，推荐若干国际权威学术期刊（但不局限于此）：Science, Nature, Nature Food, Trends in Food Science & Technology, Comprehensive Reviews in Food Science and Food Safety, Annual Review of Food Science and Technology, Critical Reviews in Food Science and Nutrition, Biosensors and Bioelectronics, Journal of Hazardous Materials, Food Chemistry, Sensors and Actuators B: Chemical, Journal of

Agricultural and Food Chemistry, Food Control, Food Research International, Journal of Food Engineering, LWT-Food Science and Technology, Journal of Food Composition and Analysis, Food Analytical Methods.

Ⅶ、Lecture(s)： Ouyang Qin, Huang Xingyi, Li Huanhuan, Wang Chengquan, Tian Xiaoyu, Waqas Ahmad

Ⅶ、任课教师：欧阳琴、黄星奕、李欢欢、王成全、田潇瑜、Waqas Ahmad

Ⅸ、Responsible for syllabus design：

Ouyang Qin

Ⅸ、教学大纲设计负责人：欧阳琴

课程介绍：现代食品仪器分析

课程名称：现代食品仪器分析

学分：3

教学时间：48 学时

教学大纲内容：

现代食品仪器分析是一门介绍现代仪器分析技术和方法在食品研究中的应用的课程。本课程为针对食品科学与工程专业领域硕士研究生的专业选修课程。

在本课程中，介绍的主要仪器分析技术通常可分为光谱分析、色谱分析、定量实时 PCR（qPCR）和 ELISA 技术。以及这些技术和方法在食品研究中的应用。

光谱技术包括紫外/可见光谱和分子荧光光谱、红外和拉曼光谱、原子吸收和 ICP 光谱、质谱（包括生物质谱、色谱质谱）。

色谱技术包括气相色谱、经典液相色谱和高效液相色谱。

定量实时 PCR（qPCR）和 ELISA

教学过程综合采用板书、演示文稿、案例分析以及实验教学等多种教学方式，并根据食品科学与工程学科的学科特点和专业背景，加强现代仪器分析方法基本理论学习与其在食品分析中实际应用的结合。通过本课程理论部分的学习，使学生进一步加深对现代仪器分析方法所依据的基础理论、基本原理的理解，熟悉分析仪器的基本构造和分析流程、定性与定量分析方法以及主要影响因素等；最终具备综合运用现代仪器分析手段对食品组分进行定性定量分析的能力；通过案例教学和实验教学，使学生熟悉掌握相关仪器的基本操作技能，具有一定的分析并解决仪器运行及操作问题的能力；通过本课程的学习，使学生具备现代仪器分析方法的应用能力，并能够根据已有的标准、分析方法解决食品分析检测过程中的实际问题，最终能够运用所学理论和技术手段制定分析方法和研究方案，为以后开展涉及食品分析检测的研究工作奠定基础。本课程主要目的在于培养学生具有良好的职业精神、职业伦理与职业道德，勇于自主实践、主动创新；培养学生综合利用现代仪器分析手段解决复杂食品分析检测问题的能力。

考核方法：

课程学习报告

Introduction of the Course: Modern Food Instrumental Analysis

Course Name： Modern Food Instrumental Analysis

Credit：3

Teaching hours：48

Contents of the Syllabus：

Modern Food Instrument Analysis is a course which introduces the application of modern instrumental analysis technology and method in food research. This course is a professional elective course for postgraduate students in the field of food science and engineering.

In this course, the main instrumental analysis technologies introduced can generally be categorized as spectroscopic, chromatographic, Quantitative Real-time PCR (qPCR) and ELISA technology. And the application of these technologies and methods in food research.

Spectroscopic technology includes UV/vis and Fluorescence Spectrometry, IR and Raman Spectrometry, Atomic Absorption and ICP Spectrometry, Mass Spectrometry (including Biological Mass Spectrometry, Chromatography-Mass Spectrometry).

Chromatographic technology includes Gas Chromatography, Classical Liquid Chromatography and High Performance Liquid Chromatography.

Quantitative Real-time PCR (qPCR) and ELISA

In the teaching process, blackboard writing, presentation, case analysis, experimental teaching and other teaching methods are comprehensively used. According to the characteristics and professional background of the discipline of food science and engineering, the combination of basic theoretical learning of modern instrumental analysis methods with their practical application in food analysis is strengthened. Through the study of the theory part of this course, students can further deepen their understanding of the basic theory and basic principle of modern instrument analysis methods, and be familiar with the basic structure and analysis process of analytical instruments, qualitative and quantitative analysis methods and main influencing factors; Finally, they have the ability to comprehensively use modern instrument analysis methods to conduct qualitative and quantitative analysis of food components; Through case teaching and experimental teaching, students will be familiar with the basic operating skills of relevant instruments and have the ability to analyze and solve the operation and operation problems of instruments; Through the study of this course, students will be able to apply modern instrument analysis methods, solve practical problems in the process of food analysis and detection according to existing standards and analysis methods, and finally develop analysis methods and research plans using the theories and technical means learned, laying a foundation for future research involving food analysis and detection. The main purpose of this course is to cultivate students to have good professional spirit, professional ethics and professional ethics, and to be brave in independent practice and initiative innovation; Cultivate students' ability to comprehensively use modern instrument analysis methods to solve complex food analysis and detection problems.

Evaluation:

Report: There will be a final report given at end of this course.

课程名称：现代仪器分析专题
课程代码：EB083200D1808

Ⅰ、学时： **48** 学时（实验: ___ 学时） **学分：** **3** ； **课程类别：** 专业选修课 ；

开课学期： 春季 学期； **考核方法：** 活动报告、实验和出勤 ；

开课单位： 食品与生物工程学院 ；

Ⅱ、适用学科和专业学位类别：

食品科学与工程，硕士、博士

Ⅲ、先修课程：

分析化学、生物化学等。

Ⅳ、教学目的

本课程的主要内容包括光谱、色谱、质谱、定量实时 PCR（qPCR）和 ELISA 等常用仪器分析方法的基本原理和应用技巧。通过本课程的学习，学生能够掌握现代常用仪器的原理、结构特点和分析方法，并具备使用各种现代仪器解决各种实际问题的能力。

Ⅴ、教学方式

PPT 教学/案例教学/实验。

Ⅵ、课程内容、学时分配

第一章 绪论 **（2 学时）**

1. 现代仪器分析的任务和基本内涵
2. 现代仪器分析的发展和分析方法分类
3. 现代仪器分析的特点和分析方法选择

要求：掌握不同仪器分析方法的共性及其特性，以及现代仪器分析技术的基本评价指标。

第二章 紫外可见吸收光谱法 **（4 学时）**

1. 光谱分析法的基本概念和内涵
2. 紫外可见吸收光谱的基本原理
3. 朗伯比尔定律的基本内涵
4. 紫外可见吸收光谱的影响因素
5. 紫外可见分光光度计的结构和基本原理
6. 紫外可见吸收光谱在定性及定量分析中的应用

实验：紫外光谱法测定食品中蛋白质浓度 **（2 学时）**

第三章 分子荧光光谱法 **（2 学时）**

1. 荧光光谱分析法的基本原理
2. 荧光量子效率

3. 荧光光谱的影响因素

4. 荧光光谱仪的基本结构和检测原理

5. 荧光光谱分析法的特点及其应用

实验：分子荧光光度法测定核黄素(维生素 B_2) **（2 学时）**

第四章　红外吸收光谱法 **（2 学时）**

1. 红外吸收光谱产生的基本原理

2. 分子振动与基团频率

3. 红外光谱仪的基本原理及其分析流程

4. 红外吸收光谱在有机化合物定性分析中的应用

实验：食品中苯甲酸的红外光谱分析 **（2 学时）**

第五章　原子吸收光谱法和 ICP **（2 学时）**

1. 原子吸收光谱法的基本原理

2. 原子吸收光谱仪及其组成和分析流程

3. 干扰及其消除方法

4. 原子吸收分析方法及应用

实验：食品中重金属的原子吸收光谱分析 **（2 学时）**

第六章 拉曼光谱法 **（4 学时）**

1. 拉曼光谱技术总述
2. 拉曼光谱仪
3. 相关应用实例

实验：利用拉曼传感方法检测食品中化学污染物 **（2 学时）**

第七章　液相色谱法 **（4 学时）**

1. 经典液相色谱

2. 高效液相色谱仪

3. 主要分离类型及原理

4. 液相色谱的固定相和流动相

5. 液相色谱定性和定量分析方法及应用

实验：食品中有机酸的液相色谱检测 **（2 学时）**

第八章 气相色谱法 **（2 学时）**

1. 气相色谱简介

2. 气相色谱仪

3. 气相色谱固定相

4. 气相色谱检测器

5. 分离操作条件的选择

6. 气相色谱定性和定量分析方法及应用

实验：酒精饮料中乙醇的气相色谱检测 **（2 学时）**

第九章 质谱 **（4 学时）**

1．质谱简介

2. 质谱分析的基本原理

3. 质谱仪的基本结构和分析过程

4. 质谱图分析

5. 色谱-质谱

实验：通过气相色谱-质谱法分析食品中的挥发性成分 **（2 学时）**

第十章 生物质谱 **（2 学时）**

1.生物质谱简介

2.质谱仪

3.电离模式（基质辅助激光解吸和电离、电喷雾电离）

4.分析仪

5.串联质谱法

6.质谱在蛋白质鉴定中的应用进展

第十一章 定量实时 PCR（qPCR）和 ELISA **（2 学时）**

1.qPCR 和 ELISA 的原理

2.qPCR 和 ELISA 的要求

3.qPCR 和 ELISA 的应用

实验：使用 qPCR 验证食品的外源基因污染 **（2 学时）**

课程学时分配表

章　节	讲　课	实　验
第一章　绪论	2	
第二章　紫外可见吸收光谱法	4	2
第三章　荧光光谱法	2	2
第四章　红外吸收光谱法	2	2
第五章　原子吸收光谱法和 ICP	2	2
第六章　拉曼光谱法	4	2
第七章　气相色谱法	2	2
第八章　液相色谱法	4	2
第九章　质谱法	4	2
第十章　生物质谱法	2	
第十一章　定量实时 PCR（qPCR）和 ELISA	2	2
合　计	**30**	**18**

Ⅶ、参考书目及学习资料

参考书目

1. Teaching material：Principles and Techniques of Practical Biochemistry (5th Edition). Keith Wilson and John Walker, Cambridge Press, 2000.
2. Reference books：Instrumental Analysis (Fifth edition). Douglas A. Skoog, F. James Holler, Timothy A. Nieman, Philadelphia : Saunders College Pub. ; Orlando, Fla. : Harcourt Brace College Publishers, c1998.
3. 现代食品检测技术. 邹小波，赵杰文. 中国轻工业出版社. 2021. 第三版
4. 现代仪器分析. 刘约权. 高等教育出版社. 2015. 第三版
5. Ahuja, S., Jespersen, N. Modern instrumental analysis. Elsevier Science Ltd.
6. Charles, S. Capillary Electrophoresis: Methods and Protocols. Humana Press.
7. Skoog A. Pinciples of instrumental analysis. 4ed. Barcourt Brace College Publishers.

学习资料：

本领域学术期刊研究论文。

Ⅶ、任课教师

丁青芝、何荣海、骆琳、赵延胜、李欢欢、张荣、李玉龙

Ⅸ、大纲撰写人：

丁青芝、何荣海、骆琳、赵延胜、李欢欢、张荣、李玉龙

Course name: Modern Food Instrument Analysis

Course code：EB083200D1808

Ⅰ、Scheduled Teaching hours： 48（experiments: 4 hours） **credits：** 3； **Course type：** Specialized Elective Course ；

Opening semester： **Spring** semester； **Assessment method：** Activity report

Opening unit： School of Food and Biological Engineering

Ⅱ、Applicable disciplines and professional degree categories：

Food Science and Engineering, MS, PhD

Ⅲ、Prerequisite course：

Analytical Chemistry、Biochemistry

Ⅳ、Teaching objective：

The main contents of the course include the basic principles and application skills of common instrument analysis methods, such as spectroscopy, chromatography, mass spectrometry, Quantitative Real-time PCR (qPCR) and ELISA. Through the learning of this course, students can master the principles, structural characteristics and analysis methods of modern common instruments, and have the ability to solve various practical problems with

various modern instruments.

Ⅴ、Teaching methods

PPT classroom instruction and experiments

Ⅵ、Course content, class hour distribution and requirements for students：

Chapter One Introduction **（2 hours）**

1. Tasks and basic connotation of modern instrument analysis
2. Development of modern instrumental analysis and classification of analytical methods
3. Characteristics of modern instrument analysis and selection of analysis methods

Chapter Two UV visible absorption spectrum （4 hours）

1．Basic Concept and Connotation of Spectral Analysis
2．The mechanism of ultraviolet visible absorption spectrum
3．Law of absorption
4．The influence factors of ultraviolet visible absorption spectrum
5．Ultraviolet visible absorption spectrometer
6．Application of UV visible absorption spectroscopy in food analysis

Experiment: Analysis of protein concentration in food by UV visible absorption spectrum **（2 hours）**

Chapter Three Fluorescence spectrum （2 hours）

1．The basic principle of fluorescence emission spectroscopy
2．Fluorescence quantum efficiency
3．Factors affecting fluorescence emission spectra
4．Fluorescence spectrometer
5．Application of fluorescence emission spectroscopy in biochemical analysis

Experiment: Analysis of Riboflavin (Vitamin B_2) by Fluorescence Spectrophotometry **（2 hours）**

Chapter Four Infrared absorption spectrum （2 hours）

1．The basic principle of infrared absorption spectroscopy
2．Relationship between infrared absorption spectrum and molecular structure
3．Infrared spectrometer
4．Application of infrared absorption spectroscopy in food analysis

Experiment: Analysis of benzoic acid in food by infrared spectroscopy **（2 hours）**

Chapter Five Atomic absorption and ICP （2 hours）

1．Summary
2．Characteristics of atomic absorption spectrometry
3．The relationship between the absorbance and the concentration of the sample
4．Atomic absorption spectrometer
5．Determination
6．ICP

Experiment: Determination of Heavy metal element in Food **（2 hours）**

Chapter Six Raman spectroscopy （4 hours）

1．Overview of Raman spectroscopy technology

2．Raman spectrometer

3．Examples of related application

Experiments： Raman based sensor for chemical contaminant in food samples **（2 hours）**

Chapter Seven Classical liquid chromatography and high performance liquid chromatography （4 hours）

1．Classification of liquid chromatography

2．Instrument of HPLC

3. Main separation types and principles

4. Stationary and mobile phases of liquid chromatography

5. Qualitative and quantitative analysis methods and application of liquid chromatography

Experiment: Determination of Organic Acids in Food by HPLC **（2 hours）**

Chapter Eight Gas chromatography （2 hours）

1. Introduction to gas chromatography

2. Gas chromatograph

3. Gas chromatographic stationary phase

4. Gas chromatographic detector

5. Selection of separation operation conditions

6. Qualitative and quantitative analysis methods and application of gas chromatography

7．Application of GC in food analysis

Experiment: Analysis of ethanol content in liquor by gas chromatography **（2 hours）**

Chapter Nine Mass spectrum （4 hours）

1．Summary of mass spectrometry

2．The basic principle of mass spectrometric analysis

3．The basic structure and analysis process of mass spectrometer

4．Analysis of mass spectrogram

5．Chromatography-mass spectrometry

Experiment: Analysis of volatile components in food by gas chromatography-mass spectrometry **（2 hours）**

Chapter Ten Biological mass spectrometry （2 hours）

1．Summary

2．Mass spectrometer

3．Ionization mode (matrix assisted laser desorption and ionization, electrospray ionization)

4．Analyzer

5．Tandem mass spectrometry

6．Progress in the application of mass spectrometry in protein identification

Chapter Eleven Quantitative Real-time PCR (qPCR) and ELISA （2 hours）

1．The principles of qPCR and ELISA

2．Requirements of qPCR and ELISA

3．Application of qPCR and ELISA

Experiment: Using qPCR to verify the exogenous genetic contamination of food **（2 hours）**

Ⅶ、Teaching material, main Reference books and Other reference materials for students：

1. Teaching material：Principles and Techniques of Practical Biochemistry (5th Edition). Keith Wilson and John Walker, Cambridge Press, 2000.
2. Reference books：Instrumental Analysis (Fifth edition). Douglas A. Skoog, F. James Holler, Timothy A. Nieman, Philadelphia : Saunders College Pub. ; Orlando, Fla. : Harcourt Brace College Publishers, c1998.
3. 现代食品检测技术. 邹小波，赵杰文. 中国轻工业出版社. 2021. 第三版
4. 现代仪器分析. 刘约权. 高等教育出版社. 2015. 第三版
5. Ahuja, S., Jespersen, N. Modern instrumental analysis. Elsevier Science Ltd.
6. Charles, S. Capillary Electrophoresis: Methods and Protocols. Humana Press.
7. Skoog A. Pinciples of instrumental analysis. 4ed. Barcourt Brace College Publishers.

Other reference materials：

Research papers in international academic journals in this field.

Ⅶ、Lecture(s)：

Qingzhi Ding, Ronghai He, Lin Luo, Yansheng Zhao, Huanhuan Li, Rong Zhang, Yulong Li

Ⅸ、Responsible for syllabus design：

Qingzhi Ding, Ronghai He, Lin Luo, Yansheng Zhao, Huanhuan Li, Rong Zhang, Yulong Li

课程简介:现代物理加工技术与设备

课程名称:现代物理加工技术与设备

学分：2

教学学时：32

教学大纲内容：

现代物理加工技术与设备是食品科学与工程专业基础课的核心内容。本课程的目的是：(1)介绍现代加工技术的背景知识，(2)介绍农产品加工中最常用的设备，(3)描述设备的工作原理及其应用。本课程主要内容包括:超声、分离、红外、分析、微波、射频、电场、低温等离子体加工技术与设备。本课程为从事食品加工和新产品开发的学生提供广泛的理论基础和实际应用技能。

Introduction of the Course: Modern Physical Processing Technologies and Equipments

Course Name：Modern Physical Processing Technologies and Equipments

Credit：2

Teaching hours：32

Contents of the Syllabus：

Modern Physical Processing Technologies and Equipments is a core of professional basic courses for food science and engineering major. The objectives of this course are to (1) introduce the background knowledge of modern processing technology, (2) represent the most commonly used equipment in agricultural product processing, and (3) describe the working principle of the equipment and its applications. The main content of this course includes: Ultrasound, Separation, Infrared, Analyzing, Microwave, Radio frequency, Electric field, and Low temperature plasma processing technology and equipment. This course provides students engaged in food processing and new product development with a broad theoretical foundation and practical application skills.

课程名称：现代物理加工技术与装备

课程代码：EB083200D1806

Ⅰ、计划学时： 32 （实验 0 学时）； **学分：** 2 ； **课程类型：** 专业选修课 ； **开课学期：** 春 学期； **授课方式：** 报告 **开课学院：** 食品与生物工程学院

Ⅱ、适用的学科及专业学位类别（领域）：

食品科学与工程博士和硕士

Ⅲ、预修课程

食品物理加工科学专题

Ⅳ、教学目的：

本课程的目的是：(1)介绍现代加工技术的背景知识，(2)介绍农产品加工中最常用的设备，(3)描述设备的工作原理及其应用。本课程主要内容包括:超声、分离、红外、分析、微波、射频、电场、低温等离子体加工技术与设备。本课程为从事食品加工和新产品开发的学生提供广泛的理论基础和实际应用技能。

Ⅴ、教学方法

1. 多媒体网络教学
2. 课程考核包括 2 部分：10%课堂考核+90%报告作业

Ⅵ、课程内容，学时分配和学生要求：

第一章 超声波技术与设备 (6 学时)

1．介绍超声波技术和使用过的设备
2．应用案例:提取、酶解、速冻

第二章 分离技术与设备 (4 学时)

1．介绍分离技术和使用过的设备
2．应用案例:膜分离、离子交换、凝胶色谱、高效液相色谱、气相色谱

第三章 红外技术与设备 (6 学时)

1．介绍红外技术和使用过的设备
2．应用案例:干燥、脱皮、漂烫、杀菌

第四章 分析技术与设备 (4 学时)

1．介绍分析技术和使用过的设备
2．应用案例:质谱

第五章 微波技术与设备 (2 学时)

1．介绍微波技术和使用过的设备
2．微波应用案例

第六章 射频技术与设备 (2 学时)

1．介绍射频技术和使用过的设备
2．射频应用案例

第七章 电场技术与设备 (4 学时)

1．介绍电场技术和使用过的设备
2．电场应用案例

第八章 低温等离子体技术与设备 (2 学时)

1．介绍低温等离子体技术和使用过的设备
2．应用案例:灭菌

研讨会 (2 学时)

Ⅶ、教材、主要参考书及其他供学生参考的资料：

主要参考书： 1. Haile Ma, Jingdun Jia, Yiqiang Ge, Ronghai He, Cunshan Zhou, Xun Wei, Wenjuan Qu, Bei Wang, Bengang Wu, Ling Sun, Zhenbin Wang, Yanyan Zhang, Henan Zhang, Oladejo Ayobami Olayemi, Zhongli Pan, Xiulian Yin. Advances in Food Physical Processing Technology, Springer Nature Singapore Pte Ltd. and

Zhejiang University Press, 2019.

其他参考资料：1. Zhongli Pan, Ruihong Zhang, Steven Zicari. Infrared drying, Infrared (IR) heating. Integrated Processing Technologies for Food and Agricultural By-Products, Elsevier Inc, 2019.

Ⅶ、任课教师（小组）： 曲文娟，周晨光，赵一鸣，王博，张志宏，吴本刚，徐保国

Ⅸ、课程大纲设计人：曲文娟

Course name: Modern Physical Processing Technologies and Equipments

Course code: EB083200D1806

Ⅰ、Scheduled Teaching hours：32（experiments: 4 hours）**credits：2**； **Course type：directional selective course**；

Opening semester：Spring semester； **Assessment method：activity report**；

Opening unit：Food and biological engineering school

Ⅱ、Applicable disciplines and professional degree categories：

Food science and engineering Doctor & Master

Ⅲ、Prerequisite course：

Special topics of food physical processing science

Ⅳ、Teaching objective：

The objectives of this course are to (1) introduce the background knowledge of modern processing technology, (2) represent the most commonly used equipment in agricultural product processing, and (3) describe the working principle of the equipment and its applications. The main content of this course includes: Ultrasound, Separation, Infrared, Analyzing, Microwave, Radio frequency, Electric field, and Low temperature plasma processing technology and equipment. This course provides students engaged in food processing and new product development with a broad theoretical foundation and practical application skills.

Ⅴ、Teaching methods

1. Multimedia teaching and network teaching

2. The examination of the course includes two parts: 10% classroom and 90% activity report

Ⅵ、Course content, class hour distribution and requirements for students：

Chapter1 Ultrasound technology and equipment （6 hours）

1．Introduction of ultrasound technology and the used equipment

2．Application cases: Extraction, enzymatic hydrolysis, snap-freezing

Chapter2 Separation technology and equipment （4 hours）

1．Introduction of separation technology and the used equipment

2．Application cases: membrane separation, ion exchange, gel, HPLC, GC

Chapter3 Infrared technology and equipment （6 hours）

1．Introduction of infrared technology and the used equipment

2．Application cases: drying, peeling, blanching, sterilization

Chapter4　Analyzing technology and equipment　（4 hours）

1．Introduction of analyzing technology and the used equipment

2．Application cases: Mass spectrum, etc

Chapter5　Microwave technology and equipment　（2 hours）

1．Introduction of microwave technology and the used equipment

2．Microwave application cases

Chapter6　Radio frequency technology and equipment　（2 hours）

1．Introduction of radio frequency technology and the used equipment

2．Radio frequency application cases

Chapter7　Electric field technology and equipment　（4 hours）

1．Introduction of electric field technology and the used equipment

2．Electric field application cases

Chapter8　Low temperature plasma technology and equipment　（2 hours）

1．Introduction of low temperature plasma technology and the used equipment

2．Application cases: sterilization

Seminar　（2 hours）

Ⅷ、Teaching material, main Reference books and Other reference materials for students：

Reference books： 1. Haile Ma, Jingdun Jia, Yiqiang Ge, Ronghai He, Cunshan Zhou, Xun Wei, Wenjuan Qu, Bei Wang, Bengang Wu, Ling Sun, Zhenbin Wang, Yanyan Zhang, Henan Zhang, Oladejo Ayobami Olayemi, Zhongli Pan, Xiulian Yin. Advances in Food Physical Processing Technology, Springer Nature Singapore Pte Ltd. and Zhejiang University Press, 2019.

Other reference materials: 1. Zhongli Pan, Ruihong Zhang, Steven Zicari. Infrared drying, Infrared (IR) heating. Integrated Processing Technologies for Food and Agricultural By-Products, Elsevier Inc, 2019.

Ⅷ、Lecture(s)： Qu Wenjuan, Zhou Chenguang, Zhao yiming, Wang bo, Zhang zhihong, Wu bengang, Xu baoguo

Ⅸ、Responsible for syllabus design： Qu Wenjuan

课程简介：高级营养学

课程名称：高级营养学

学分：3.0

学时：48

课程内容：

《高级营养学》重点关注：1)了解食品科学、营养科学和医学交叉学科的基础知识；2)介绍营养科学的最新进展和跨学科研究领域的相关课题，包括分子营养学、营养物质的消化吸收与代谢、营养物质与疾病的关系等。

本课程涉及基因组学、蛋白质组学、代谢组学、系统生物学及其在食品营养与代谢研究中的应用。目前关于食物营养的研究不仅局限于营养素摄入不足引起的营养缺乏性疾病，还将重点放在营养素过量引起的慢性疾病的预防上。

通过本课程的学习，学生需要了解食品营养学领域研究的最新进展和发展趋势，掌握人体内各种营养物质的消化代谢过程，学习营养学研究的新方法和新技术。通过本课程，学生能够：1)了解营养物质与人体健康之间的重要关系；2)了解营养物质对人体健康的风险和益处；3)将营养知识应用于功能食品和保健品的研发。

评价：公开考试/论文报告

Introduction of the Course: Advanced Nutrition

Course Name：Advanced Nutrition

Credit：3.0

Teaching hours：48

Contents of the Syllabus：

Advanced Nutrition focuses on 1). understanding the interdisciplinary fundamental knowledges in Food Science, Nutritional Science, and Medicinal Science; 2). Introducing the recent progresses in nutritional science and the topics related to the interdisciplinary research areas that include molecular nutrition, and digestion absorption and metabolism of nutrients, and the relationship between nutrients and diseases.

This course involves genomics, proteomics, metabolomics, system biology and their application in food nutrition and metabolic research. The present studies regarding food nutrition is not limited to nutritional deficiency diseases induced by insufficient intake of nutrient, but also focus on the prevention of chronic disease by excess nutrients.

By learning this course, students need to understand the latest progress and development trend of research in the

field of food nutrition, master the digestive and metabolic processes of all kinds of nutrients in the body, learn the new research methods and techniques with nutrition. From this course, the students are able to: 1) understand the critical relationships between nutrients and human health; 2) know the risks and benefits of nutrients to human health; and 3). apply the nutritional knowledge to functional foods and nutraceuticals R&D.

Evaluation: Open Exam / Essay Report

课程名称 Course name: 高级营养学 Advanced Nutrition

课程代码 Course code: EB083200C1805

一、计划学时：48 （其中实验 0 学时）； **学分**： 3.0 ； **开课学期**：第 I 学期

Total Hours: 48 (Experiment hour 0); **Credit**: 3.0, **Term**: I term

授课方式：板书/ PPT **考核方式**：报告

Teaching: Blackboard/PPT; **Evaluation**: Assignment and Report

二、适用的学科及专业学位类别（领域）（Major）

食品科学与工程博士研究生、食品科学与工程学术型硕士、生物与医药专业型硕士。

PhD students of Food Science and Engineering; Master of Science students of Food Science and Engineering; Master of Engineering students of Biological, Medicinal and Pharmaceutical Science

三、预修课程（Prerequisite）

微生物学、生物化学、食品化学、食品营养学。

Microbiology, Biochemistry, Food Chemistry, Food Nutriology

四、教学目的 (Aim)

本门课程在了解食品科学、营养科学、医学科学等学科交叉的基础上，综合国内外相关研究进展，综合介绍营养学领域中更为深入和新近的研究内容，就营养学基础和应用其它学科相互交叉、渗透的相关题目，如分子营养学、营养与消化吸收、营养与代谢等方面的研究成果进行深入探讨。通过该课程的学习，建立食品营养与人类健康的重要关联，为研究食品营养素对人的双向作用和营养健康食品开发奠定基础。

Advanced Nutrition focuses on 1) understanding the interdisciplinary fundamental knowledges in Food Science, Nutritional Science, and Medicinal Science; 2) Introducing the recent progresses in nutritional science and the topics related to the interdisciplinary research areas that include molecular nutrition, and digestion absorption and metabolism of nutrients, and the relationship between nutrients and diseases. From this course, the students are able to: 1) understand the critical relationships between nutrients and human health; 2) know the risks and benefits of nutrients to human health; and 3) apply the nutritional knowledge to functional foods and nutraceuticals R&D.

五、课程内容及学时分配 (The contents and hour distribution)

第一章 主要营养素的消化、吸收、运输和代谢 （8 学时）

1.1 人体消化系统

1.2 碳水化合物的消化、吸收、运输和代谢

1.3 蛋白质的消化、吸收、运输和代谢

1.4 营养素消化、吸收和代谢的研究方法

Chapter 1 Digestion, absorption, transport and metabolism of macronutrient (8 class hours)

1.1 Human digestive system

1.2 Digestion, absorption, transport and metabolism of carbohydrates

1.3 Digestion, absorption, transport and metabolism of proteins

1.4. Research methods for nutrient digestion, absorption and metabolism

第二章 植物化合物与人体健康 （4 学时）

2.1 植物化合物的种类

2.2 植物化合物的功能

2.3 植物化合物的消化和吸收

2.4 提高植物化合物吸收率的方法

Chapter 2 Phytochemicals and Human Health (4 class hours)

2.1 Classification of phytochemicals

2.2 Functions of Phytochemicals

2.3 Digestion and Absorption of Phytochemicals

2.4 Methods for increasing phytochemical absorption

第三章 膳食纤维与人体健康 （8 学时）

3.1 膳食纤维的定义、分类和来源

3.2 常见膳食纤维的特性

3.3 膳食纤维特性与生理功能的关系

3.4 膳食纤维的健康效应

3.5 膳食纤维相关的食品标识

3.6 膳食纤维的研究现状与展望

Chapter 3 Dietary Fiber and Human Health (8 class hours)

3.1 Definition, classification and origin of dietary fiber

3.2 Characteristics of common dietary fiber

3.3 Relationship between dietary fiber properties and physiological functions

3.4 Health effects of dietary fiber

3.5 Food labeling related to dietary fiber

3.6 Research status and prospect of dietary fiber

第四章 蛋白质与人体健康（8 学时）

4.1 蛋白质结构与功能特性

4.2 蛋白质来源及营养价值

4.3 多肽的生理活性

Chapter 4 Protein and human health (8 class hours)

4.1 Protein structure, function, & functionality

4.2 Protein source and their nutritional values

4.3 Biological function of peptides

第五章 糖代谢与人体健康（共 6 学时）

5.1 食物血糖应答与血糖生成指数

5.2 胰岛素抵抗及糖尿病

5.3 食品营养对胰岛素抵抗和糖尿病的干预

Chapter 5 Carbohydrate metabolism and human health (6 class hours)

5.1 Food glucose response and glycemic index

5.2 Insulin resistance and diabetes

5.3 Intervention of food nutrients on insulin resistance and diabetes

第六章 脂质代谢与人体健康（4 学时）

6.1 脂质的消化、吸收和传送

6.2 脂类的分解代谢、合成代谢

6.3 动脉粥样硬化的定义、临床表现、病理特征、病因与发病机制

6.4 植物化学物与脂质代谢紊乱、动脉粥样硬化

Chapter 6 Lipid metabolism and human health (4 class hours)

6.1 Lipid digestion, absorption and delivery

6.2 Catabolic and anabolic metabolism of lipids

6.3 Definition, clinical manifestations, pathological characteristics, etiology and pathogenesis of atherosclerosis

6.4 The role of phytochemicals in preventing lipid metabolism disorder and atherosclerosis

第七章 肠道菌群与人体健康 （10 学时）

7.1 肠道菌群组成与结构

7.2 肠道菌群与慢性非传染性疾病

7.3 益生菌与肠道健康

7.4 益生元与肠道健康

Chapter7 Microbiota and human health (10 class hours)

7.1 The Composition and structure of microbiota

7.2 Microbiota and chronic non-communicable diseases

7.3 Probiotics and intestinal health

7.4 Prebiotics and intestinal health

六、教材及主要参考书目(Textbook and main bibliography)

1. 林晓明主编. 高级营养学. 北京: 北京大学医学出版社, 2016。

Lin Xiaoming. Advanced nutrition. Beijing: Peking University Medical Press, 2016.

2. 相关领域的国际权威学术期刊: Science、Nature、Annual Review of Food Science and Technology、Critical Reviews in Food Science and Nutrition、Molecular Nutrition & Food research、Trends in Food Science & Technology、Journal of Functional Foods、Food Microbiology、International Journal of Food Microbiology、Journal of Agricultural and Food Chemistry、Food Chemistry 等.

七、任课教师（小组）(The teacher)

肖 香 陈秀敏 李海腾 包玉龙 祝 莹

Xiao Xiang, Chen Xiumin, Li Haiteng, Bao Yulong, Zhu Ying

八、大纲撰写人（Author of outline）

肖 香　陈秀敏　李海腾　包玉龙　祝 莹

Xiao Xiang, Chen Xiumin, He Wenseng, Zhu Ying

《现代微生物学》课程简介

课程名称： 现代微生物学

课程代码：ES083200B1801

授课对象：博士生、学术学位和专业学位硕士研究生

学　　分：2

学　　时：32

课程内容：

《现代微生物学》课程内容主要包括微生物菌株的分离鉴定与菌种保藏、微生物菌种改良与重组技术研究进展、传统发酵产品的微生物学基础及食品发酵优化与控制、食品中微生物的控制、食品微生物生态与清洁生产，以及果蔬采后病原微生物的侵染及病害控制技术六个部分。第一部分—微生物菌株的分离、纯化与菌种保藏, 主要讲授从各种样品中分离、纯化和保藏微生物菌株的主要方法和原理，以及从事现代微生物学研究必须掌握的微生物分类学的基础理论和研究技术。第二部分—微生物菌种改良方法及其研究进展，重点介绍菌种改良的传统方法和现代基因工程技术及其在微生物菌种改良中的研究进展，主要方法包括自然选育、诱变育种、杂交育种、原生质体融合、基因工程，并举例介绍这些方法在微生物育种中的最新研究进展，明确传统方法与基因工程各自的优缺点，并会根据实际情况选择不同的菌种改良方法。第三部分—传统发酵产品的微生物学基础及食品发酵优化与控制，主要通过介绍传统发酵产品生产过程中的关键微生物，如细菌和真菌等的生理生化特征及其发酵过程中的功能和角色，讲授食品发酵过程中优化和控制关键技术，培养分析和解决食品生物技术领域问题的能力。第四部分—食品中微生物的控制，重点介绍不同生物安全级别下的微生物及其处理方法。介绍化学食品防腐剂和天然化学食品防腐剂的优缺点、化学结构和作用方式以及控制微生物生长的新型物理方法及其抑菌机制。第五部分—食品微生物生态与清洁生产，介绍不同食物中的天然微生物菌群和病原体的流行情况，以及食品加工、运输和储存阶段的微生物修饰对食品质量的影响。本章重点介绍影响食品微生物的环境因素影响。探讨具体环境因素的科学原理、测量方法，以及对腐败生物和病原体的生长和生存能力的影响。还涉及生产控制措施以及与其他因素的相互关系。第六部分—果蔬采后病原微生物的侵染及病害控制技术主要包括致病菌侵染果蔬及病原菌与果蔬的互作机制、果蔬采后病害主要控制技术、果蔬采后病害生物防治研究进展等。

Introduction of the Course: Modern Microbiology

Course Name： Modern Microbiology

Credit： 2

Teaching hours： 32

Contents of the Syllabus：

The course *Modern Microbiology* mainly includes six parts: Isolation, purification and identification of microorganism; Expression and export: recombination protein production system by microorganism; Microbial basis of traditional fermented food/Optimization and control food fermentation process; Control of microbial growth in the food; Food microbial ecology and cleaner production; Pathogenic mechanism and drug resistance mechanism of pathogenic microorganisms. The first part, isolation，purification and preservation of microbial strains focuses on the main methods of isolation and purification of different microorganisms from various samples, as well as the methods and principles of long-term preservation of the strains obtained. Furthermore, modern microbial classification and identification mainly focus on the basic theory and research technology of microbial taxonomy involved in modern microbiological research. The second part, focuses on the traditional methods and modern genetic engineering techniques for microbial strain improvement. Introduce the latest research progress of these methods in microbial breeding with examples to clarify the advantages and disadvantages of traditional methods and genetic engineering in food industry, respectively. The third part, introduces the physiological and biochemical characteristics of key microorganisms in the production process of traditional fermentation products systematically, such as bacteria and fungi, and their functions and roles in the fermentation process, and teaching key technologies for optimization and control in the food fermentation process, the ability to analyze and solve problems in the field of food biotechnology is cultivated. The fourth part, introduces microorganisms of various biological safety levels and methods used for handling microbes at each level according to biological safety levels. Explain the common physical methods for controlling microbial growth and innovative physical methods used in controlling microbial growth. Comparing advantages and disadvantages of innovative physical methods, discuss the mechanisms that cause microbial death. The fifth part, focuses on the impact of environmental factors on food microorganisms. Discuss the scientific principles of specific environmental factors, measurement method, and the impact on the growth and viability of putrefactive organisms and pathogens. The

sixth part, the content of biological control of postharvest diseases of fruits and vegetables will be emphasized during the class. Specifically, the experience of our research groups on the isolation, screening and identification of biocontrol yeasts in pollution-free orchards will be shared to reveal the effect, physiological mechanism and molecular mechanism of biocontrol yeasts on controlling postharvest diseases of fruits and vegetables.

《现代微生物学》教学大纲

课程代码：ES083200B1801

一、计划学时： 32 （其中实验 0 学时）；**学分：** 2 ；**课程类别：**基础理论课 ；

开课学期：第 1 学期；**考核方式：**闭卷考试/开卷考试/小报告/口头考试;

开课单位： 食品与生物工程学院 ；

二．适用学科和学位类别： 食品科学与工程 ，博士/学硕/专硕；

三．先修课程：微生物、生物化学、食品生物技术等课程

四、教学目的：

通过本课程的学习，使学生了解国内外微生物研究领域（主要是食品微生物领域）的主要研究方向、研究热点以及发展趋势，掌握微生物领域研究的核心技术和方法。

五、教学方式：

案例（一）：

在讲授“微生物菌株的分离、鉴定与菌种保藏”时，采用任务驱动发，结合讨论法。上课时，给同学们提出任务“分离可应用于食品工业不同用途的微生物”，让同学们分组讨论相应的样品采集应该从哪个环境着手，然后再进一步展开介绍微生物分离、鉴定与菌种保藏的实例。向同学们介绍环境中蕴藏丰富的微生物资源，可采用基于环境 DNA 的宏基因组高通量测序技术和现代纯培养技术，研究不同环境中微生物的种群分布与群落构成，比较不同环境下同种微生物的生物学特性，并运用基于多基因分析方法进行系统分类，对于食品微生物资源挖掘及工业酶制剂的开发有重要的意义。

案例（二）：

在讲授“微生物菌种改良与重组工程技术研究进展”时，采用多媒体教学课件演示与讲解，结合讨论法、启发式教学法。首先，通过给学生提前布置查阅有关“转基因食品”相关文献，使学生对“转基因食品”及相关技术有初步认识。课堂上，先让同学们讨论什么是“转基因食品”，由此引入由微生物菌种改良和重组技术生产的食品是否为转基因食品，介绍微生物菌种改良和重组技术在食品工业中的应用和意义。进一步深入讲解微生物菌种改良与重组的技术和方法、几种类型基因编辑技术在微生物菌种选育中的研究进展、

优缺点及其适用范围。

案例（三）：

在讲授“食品中微生物的控制”时，结合启发式教学模式与讨论法。 课堂上，启发同学们：为了保证食品的安全和预防人类疾病，有必要控制食物中微生物的生长及其数量。与特定病原体相关的风险决定了生物安全水平，基于生物水平安全引出不同生物安全级别下的微生物及其处理方法。让同学们结合自己的研究和文献报道，分组讨论控制微生物生长的常规物理方法，比较化学食品防腐剂和天然化学食品防腐剂的优缺点、化学结构和作用方式以及控制微生物生长的新型物理方法及其抑菌机制。

案例（四）：

在讲授“果蔬采后病害生物防治”时，结合讨论法与启发式教学模式，采用多媒体教学课件演示与讲解。首先，结合各种文献资料，让学生了解不同果蔬的主要致病菌，对各种致病菌引起的果蔬采后病害有初步认知，启发学生思考防治果蔬采后病害的常用方法；其次，上课时，着重讲述生物防治果蔬采后病害的内容，以课题组在无公害果园分离、筛选并鉴定生防酵母菌为例，讲述生防酵母菌防治果蔬采后病害的效果，生理机制和分子机制。最后，结合生防酵母对果蔬采后病害的防治效果与化学杀菌剂相比，组织学生讨论提高生防酵母防治果蔬采后病害效果的方法。

六、课程内容、学时分配和对学生的要求：

（一）课程内容

课程主要包括微生物菌株的分离、鉴定与菌种保藏；微生物菌种改良与重组工程技术研究进展；传统发酵产品的微生物学基础及食品发酵优化与控制；食品中微生物的控制；食品微生物生态与清洁生产；果蔬采后病原微生物的侵染及病害控制技术等六个部分的内容。

（二）学时分配

1. 微生物菌株的分离、鉴定与菌种保藏（4 学时）
2. 微生物菌种改良与重组工程技术研究进展（8 学时）
3. 传统发酵产品的微生物学基础及食品发酵优化与控制（4 学时）
4. 食品中微生物的控制（6 学时）
5. 食品微生物生态与清洁生产（2 学时）
6. 果蔬采后病原微生物的侵染及病害控制技术（8 学时）

（三）对学生的要求

本课程为适用于食品科学与工程专业的博士研究生、食品科学与工程专业和生物与医药专业的学术学位硕士研究生和专业学位硕士研究生，内容与食品相关微生物关系密切，在国内外相关研究成果快速更新的现代社会，需要紧跟国内外相关科研成果。但课堂学时有限，因此需要学生利用课余时间根据任课教师的指导查阅部分相关文献。

七、参考书目及学习资料

教材：本课程无固定教材。

参考书：本课程无参考书。

必读参考资料：主要参考相关领域的国际权威学术期刊。Science、Nature、Cell、Proceedings of the National Academy of Sciences (PNAS)、Critical Reviews in Microbiology、Food Microbiology、International Journal of Food Microbiology、Current Microbiology、Postharvest Biology and Technology、Food Control、International Journal of Systematic and Evolutionary Microbiology、Applied and Environmental Microbiology、World Journal of Microbiology and Biotechnology、FEMS Microbiology Review、Molecular Microbiology、Applied Microbiology and Biotechnology 等。

八、授课教师：张红印、朱琳、崔奉杰、钱静亚、杨其亚、霍书豪、郭丹钊、Dhanasekaran Solairaj

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Course name: Modern Microbiology

Course code：ES083200B1801

I、Scheduled Teaching hours： 32 （experiments: 0 hours） credits: 2 ; **Course type：** Basic Theory Course;

Opening semester： Autumn semester**; Assessment method：** Written examination/ Open book written test / activity report/Oral quiz;

Opening unit： School of Food and Biological Engineering

II、Applicable disciplines and professional degree categories：

Applicable to the Doctor’s Degree and academic master's degree students majoring in Food Science and Engineering or professional master's degree students majoring in Biology and Medicine.

III、Prerequisite course：

Microbiology, Biochemistry and Food Biotechnology, etc.

IV、Teaching objective：

Through the study of this course, students can understand the main research directions, research hotspots and development trends in the field of microbial research (mainly the food microorganisms)

at home and abroad, and master the core research technologies and methods in the field of microorganism.

V、Teaching methods

The main teaching methods of this course are lecture approach, task driven approach and discussion approach, etc.

Case 1:

When teaching "the isolation, identification and preservation of microbial strains", the method of task-driven approach combined with discussion are adopted. In class, the students are given the task of "Isolating microorganisms for different uses in the food industry". The students are asked to discuss in groups how to collect samples from which environment. And then examples of microbial isolation, identification and strain preservation are introduced. Furthermore, based on macro environmental DNA genome technology and modern culture technology, different species of microbes in food distribution and community structure, the biological characteristics of different environment with the kinds, and the method based on the analysis of genetic system classification are further introduced, which are significant for the development of food microorganism resources exploiting and industrial enzyme preparation.

Case 2:

When teaching “Expression and export: recombination protein production system by microorganism”, the multimedia teaching courseware demonstration, combined with heuristic teaching and discussion approach are adopted. Before the class, the students are asked to consult relevant literature on "genetically modified food" to have a preliminary understanding of "genetically modified food". In class, students discuss what is "genetically modified food", whether the food produced by microbial strain breeding and recombination technology is “genetically modified food”. And then, the application and significance of microbial strain breeding and recombination technology in the food industry are further expounded. Finally, the techniques and methods of microbial strains breeding, the research progress of several types of gene editing techniques in microbial strains breeding, their work principle, advantages and disadvantages, and their application scope are elaborated.

Case 3:

When teaching "Control of microorganism in food", the discussion approach is used. In order to

ensure food safety and prevent human diseases, it is necessary to control the growth and number of microorganisms in food. The risk associated with a specific pathogen determines the biosafety level, and microorganisms are at different biosafety levels. In class, according to their own research and literature reports, students are asked to discuss conventional physical methods for controlling microbial growth in groups, and compare the advantages and disadvantages, chemical structures and modes of action of chemical food preservatives and natural chemical food preservatives, as well as new physical methods for controlling microbial growth and their antibacterial mechanisms.

Case 4:

When teaching "Biological control of postharvest diseases of fruits and vegetables", the discussion method of teaching and the elicitation teaching mode will be combined, and the multimedia teaching courseware will be used for demonstration and explanation. Firstly, by assigning students to pre-read literature materials, students will know the primary pathogens of different fruits and vegetables, have a preliminary understanding of postharvest diseases and think about the usual methods of preventing and controlling postharvest diseases of fruits and vegetables. Secondly, the content of biological control of postharvest diseases of fruits and vegetables will be emphasized during the class. Specifically, the experience of our research groups on the isolation, screening and identification of biocontrol yeasts in pollution-free orchards will be shared to reveal the effect, physiological mechanism and molecular mechanism of biocontrol yeasts on controlling postharvest diseases of fruits and vegetables. Lastly, students will be organized to discuss methods of improving the efficiency of yeast controlling postharvest diseases when comparing biocontrol and chemical control methods.

VI、Course content, class hour distribution and requirements for students：

1 course content

This course mainly includes six parts: Isolation, purification and identification of microorganism; Expression and export: recombination protein production system by microorganism; Microbial basis of traditional fermented food/Optimization and control food fermentation process; Control of microbial growth in the food, Food microbial ecology and cleaner production; Pathogenic mechanism and drug resistance mechanism of pathogenic microorganisms.

2 class hour distribution

Isolation, purification and identification of 4 credit hours

microorganism	
Expression and export: recombination protein production system by microorganism	8 credit hours
Microbial basis of traditional fermented food/Optimization and control food fermentation process	4 credit hours
Control of microbial growth in the food	6 credit hours
Food microbial ecology and cleaner production	2 credit hours
Pathogenic mechanism and drug resistance mechanism of pathogenic microorganisms	8 credit hours

3 requirements for students

The course is applicable to the academic degree graduate students in Food Science and Engineering and professional degree graduate students in Biology and Medicine. Its content is closely relevant to food related microorganisms. In the modern society where relevant research results are rapidly updated, there is a need to keep up with relevant research findings at home and abroad. However, the class hours are limited, thus students need to use their spare time to consult some relevant literature according to the guidance of teachers.

VII、Teaching material, main Reference books and Other reference materials for students：

Reference books：no reference book for this course

Other reference materials：referring to international authoritative academic journals in relevant fields (Science、Nature, Cell, Proceedings of the National Academy of Sciences, Critical Reviews in Microbiology, Food Microbiology, International Journal of Food Microbiology, Current Microbiology, Postharvest Biology and Technology, Food Control, International Journal of Systematic and Evolutionary Microbiology, Applied and Environmental Microbiology, World Journal of Microbiology and Biotechnology, FEMS Microbiology Review, Molecular Microbiology, Applied Microbiology and Biotechnology, etc.)

VIII、Lectures：

Zhang Hongyin, Zhu Lin, Cui Fengjie, Qian Jingya, Yang Qiya, Huo Shuhao, Guo Danzhao, Dhanasekaran Solairaj

IX、Responsible for syllabus design：

Zhang Hongyin, Zhu Lin, Cui Fengjie, Qian Jingya, Yang Qiya, Huo Shuhao, Guo Danzhao, Dhanasekaran Solairaj