

## 硕士留学生课程简介及大纲（2022 修订双语版）

### The Master Degree Course Introduction and Syllabus for Overseas

### Postgraduate Students (2022 Bilingual version)

#### 《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, 采用任务驱动法, 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

**九、大纲撰写人：**张红印、朱琳、崔奉杰、钱静亚、杨其亚、霍书豪、郭丹钊、Dhanasekaran Solairaj

**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 microorganism	4 credit hours
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

## **课程简介：食品物性学**

**课程名称：**食品物性学

**学分：**2

**学时：**32

**教学大纲内容：**

食品物性学是以食品(包括食品原料及中间产品)为研究对象,研究食品系统的物理结构、性质和变化及其机理的一门科学。食品物性学是物理学领域中的一个分支学科。食品的性质由其组织结构和材料的组成成分所决定,对于食品原料(农产品)的性质来说,食品的性质可分为生物学特性、化学特性和物理特性等。食品物性学是食品科学与工程领域的基础学科,主要研究各种食品具有共性的物理特性。食品物性学与食品化学和营养生理学被称为食品加工利用研究领域非常重要的三大基础学问。课程内容主要包括食品的基本物理特征、食品的流变力学特性、食品质地及其评价、散粒食品的力学特性、食品的流体动力学特性、食品的热特性、食品的光学特性与颜色、食品的电磁学特性、食品的声特性。食品物性学可为食品加工和食品品质的检测及控制提供理论指导。

## **Introduction of the Course: Physical Properties in Foods**

**Course Name: Physical properties in foods**

**Credit: 2**

**Teaching hours: 32**

**Contents of the Syllabus:**

“Physical Properties in Foods” is a course that studies the mechanisms, physical structure, properties in foods (including food raw materials and intermediate products). Food physics is a branch of physical science. The nature of food is determined by its organizational structure and the composition of the material. For the properties of food raw materials (agricultural products), the properties of food can be divided into biological characteristics, chemical characteristics and physical characteristics. Food physics is a basic subject in the field of food science and engineering, which mainly studies the common physical characteristics of various foods. Food physics, food chemistry and nutritional physiology are called three very important basic knowledge in the field of food processing and utilization.

At the completion of this course the student should be able to learn the physical properties of food and staple agricultural products. It also includes examination of the Optics, Mechanics, Electricity, Thermal and Rheology

properties of food. In the procedure of food processing and preservation, making use of the physical properties for food quality assurance. Food properties can provide theoretical guidance and quality detection and control for food processing. This course also enables students to broaden knowledge, broaden their thinking, inspire innovation, and make use the principle of food physics for their research.

**课程名称：**食品物性学

**课程代码：**ES083200B1802

**一、计划学时：**32（其中实验 8 学时）； **学分：**2； **课程性质：**基础理论课；

**开课学期：**第I学期； **考核方式：**开卷笔试、作业报告、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：**

本课程适用于食品科学与工程学科、生物与医药（食品工程领域）专业学位。

**三、预修课程：**

大学物理、食品工程原理。

**四、教学目的：**

食品物性学是食品科学与工程学科和食品工程专业领域的专业基础课程，主要研究作业对象的物理特性及其变化规律，并与之对应物理特性测定的基本原理和方法。通过本课程教学，使学生掌握和了解食品物料的基本物理特性及其检测的基本原理和基本方法，拓宽学生的知识面、开阔学生思路、启发学生的创新意识，从而开创食品物料物理加工和检测及分析的新方法、新原理、新途径。理解诸葛亮《知人：“七观”》，解析其与食品物性探索的关系，领会学、习、研三者关系。

**五、教学方式**

课堂讲授、案例分析与讨论

**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. 基本概念
2. 研究的范围与课程的专业地位
3. 典型案例分析与研讨

**第二章 食品物料的基本物理特性** (3 学时)

1. 物料的组织结构
2. 形状、尺寸与粒度
3. 密度与孔隙率
4. 典型应用案例分析与研讨

### **第三章 食品物料的流变力学特性**

(6 学时)

1. 基本概念
2. 理想材料的力学性质及模型
3. 液体物料的流变力学特性
4. 固体物料的流变力学特性
5. 食品质地及其评价
6. 流变力学特性的应用分析
7. 典型应用案例分析与研讨

### **第四章 散粒体食品物料的力学特性**

(3 学时)

1. 摩擦特性
2. 黏附性与黏聚性
3. 散粒体的变形与抗剪强度
4. 散粒体的流动特性
5. 物料对容器的压力
6. 典型应用案例分析与研讨

### **第五章 食品物料的热特性**

(2 学时)

1. 水和冰的热特性
2. 食品的热特性及其测定
3. 典型应用案例分析与研讨

### **第六章 食品物料的光特性**

(3 学时)

1. 光的基本性质
2. 颜色的基本表征系统
3. 食品光特性检测模式及系统
4. 光谱和图像检测技术
5. 典型应用案例分析与研讨

### **第七章 食品物料的电磁特性**

(2 学时)

1. 概述

2. 食品的电磁学特性
3. 典型应用案例分析与研讨

## 第八章 食品物料的声特性

(2 学时)

1. 声特性的基本概念和基本理论
2. 典型应用案例分析与研讨 (声特性)
3. 典型应用案例分析与研讨 (超声特性)

### 实验:

1. 直条型食品力学质地的测定 (2.0 学时)
2. 食品 TPA 测定 (2.0 学时)
3. 卵形体农产品大小头定向运动规律的测定(结合案例分析) (1.0 学时)
4. 食品物料的光特性测定(结合案例分析)[近红外光谱] (1.0 学时)
5. 食品物料的声特性测定(结合案例分析)[声和超声] (2.0 学时)

## 七、教材、主要参考书目及学生必读参考资料:

**教材:** Physical Properties of Foods, Serpil Sahin and Servet Gulum Sumnu, Springer. 2005

**参考书:** 姜松, 赵杰文. 食品物性学[M]. 北京: 化学工业出版社, 2016.

李里特. 食品物性学[M]. 北京: 中国农业出版社, 2001.

李云飞, 殷涌光, 金万浩. 食品物性学[M]. 北京: 中国轻工业出版社, 2005.

屠康, 朱文学, 姜松. 食品物性学[M]. 南京: 东南大学出版社, 2006.

**必读参考资料:** 食品物性学. 江苏大学精品课程网: <http://kc.ujs.edu.cn/site83/>

## 八、任课教师 (小组):

林颢、张磊、姜松

## 九、大纲撰写人:

林颢、张磊、姜松

**Course name: Physical properties in foods**

**Course code: ES083200B1802**

**I 、 Scheduled Teaching hours: 32 (experiments: 8 hours) credits: 2 ; Course type: Basic theoretical course;**

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

**Opening unit: School of food and biological engineering**

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

### III、Prerequisite course:

College Physics, Theory of Food Engineering

### IV、Teaching objective:

“Food Physics” is a professional foundation course for Major of Food Science & Engineering, and it is major basic course. It is introduced that the physics properties and principle of food materials, and the test way of physics properties. The knowledge and thinking of the students is widened, and the innovative thinking is inspired by this course teaching. It is possible for the students to apply the physics principle to the engineering and technology. The new equipment design, the new way, technology and principle of processing are created. This course also enables students to broaden knowledge, broaden their thinking, inspire innovation, and make use the principle of food physics for their research.

### V、Teaching methods

Class teaching, case analysis and discussion

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

#### Chapter 1 Introduction

(3 classes)

1. Basic concept of physical properties of foods
2. Region and role of physical properties of foods in professional culture system
3. Analysis and discussion on applications of physical properties of foods during the processing of production

#### Chapter 2 Basic Physics Properties of Foods

(3 classes)

1. Organization structure of materials
2. Shape, size and granularity
3. Density and porosity
4. Analysis and discussion on typical applications

#### Chapter 3 Rheological Mechanical Properties of Foods

(6 classes)

1. Basic conception
2. Mechanical properties and models of ideal materials
3. Rheological properties of liquid foods
4. Rheological properties of solid foods
5. Basic concept and evaluation methods of food texture
6. Application of rheological mechanical properties in the engineering area
7. Analysis and discussion on typical applications

#### Chapter 4 Mechanical Properties of Food Granular Mixtures

(3 classes)

1. Friction characteristics of granular mixtures
2. Adhesion and cohesion of granular mixtures
3. Deformation and shear strength of granular mixtures
4. Basic theory of granular flowing
5. Pressure between vessel and granular mixtures
6. Analysis and discussion on typical applications

**Chapter 5 Thermal Characteristics of Food (2 classes)**

1. Thermal characteristics of water and ice
2. Measurement methods of the main parameters of thermal characteristics
3. Analysis and discussion on typical applications

**Chapter 6 Optical Characteristics of Foods (3 classes)**

1. Basic concept of optical characteristics
2. Characterization systems of food color
3. Measurement methods of food optical characteristics
4. Measurement technologies of spectrum and images
5. Analysis and discussion on typical applications

**Chapter 7 Electrical Characteristics of Foods (2 classes)**

1. Basic concept of electrical characteristics of foods
2. Electrical characteristics of foods and its measurement
3. Analysis and discussion on typical applications

**Chapter 8 Acoustic Characteristics of Foods (2 classes)**

1. Basic concept of acoustic characteristics
2. Analysis and discussion on typical applications (acoustic characteristics)
3. Analysis and discussion on typical applications (ultrasonic characteristics)

**Experiment:**

1. Measurement of mechanical texture of straight foods (2 classes)
2. Measurement of TPA (2 classes)
3. Detection of orientation movement of oval agriculture products (1 classes)
4. Measurement of food optical characteristics (By case analysis) [Infrared] (1classes)
5. Measurement of food acoustic characteristics (By combination of case analysis) (2classes)

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

**Teaching material:** Physical Properties of Foods, Serpil Sahin and Servet Gulum Sumnu, Springer. 2005.

**Reference books:** 姜松, 赵杰文. 食品物性学[M]. 北京: 化学工业出版社, 2016.

**Other reference materials:**

李里特. 食品物性学[M]. 北京: 中国农业出版社, 2001.

李云飞, 殷涌光, 金万浩. 食品物性学[M]. 北京: 中国轻工业出版社, 2005.

屠康, 朱文学, 姜松. 食品物性学[M]. 南京: 东南大学出版社, 2006.

**VII、Lecture(s):**

林颢 Hao Lin、张磊 Lei Zhang、姜松 Song Jiang

**IX、Responsible for syllabus design:**

林颢 Hao Lin、张磊 Lei Zhang、姜松 Song Jiang

## **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

## 课程简介：食品无损检测基础

**课程名称：**食品无损检测基础

**课程代码：**ES083200C1803

**学分：**3

**学时：**48

**大纲内容：**

食品无损检测是典型的多学科交叉研究领域，包含物性学、数学、电子信息、模式识别、智能控制等多门学科知识。它利用被检测对象本身的光、声、电、磁、力等特性得到与被检对象内外品质相关的信息，通过这些信息与被检测对象品质指标间的相关关系建立识别模型，从而实现对食品品质的快速无损检测 and 智能评价。本课程讲述的食品无损检测技术包括计算机视觉技术、近红外光谱技术、高光谱和多光谱成像技术、荧光光谱成像技术、生物传感器技术、同领域国际最新技术及发展趋势和挑战。本课程旨在帮助学生理解食品无损检测的基本概念、基础理论和技术原理，熟悉各种无损检测技术和装置，掌握各种食品无损检测方法的特性和应用场景。为在本领域进一步学习和研究打下坚实基础。以期学生今后能在食品智能化评判、食品生产过程智能化控制中设计食品无损检测新方法、开发食品无损检测新技术、创制食品无损检测新装备、拓展食品无损检测技术适用领域。

## **Introduction of the Course: Basis for Food Nondestructive Detection**

### **Techniques**

**Course Name:** Basis for Food Nondestructive Detection Techniques

**Course code:** ES083200C1803

**Credit:** 3

**Teaching hours:** 48

### **Contents of the Syllabus:**

Food nondestructive detection is a typical interdisciplinary research field, including physical properties, mathematics, electronic information, pattern recognition, intelligent control and other disciplines of knowledge. It makes use of the characteristics of light, sound, electricity, magnetism and force of the tested object to obtain the information related to the internal and external quality of the tested object, the recognition model is established by the correlation between the information and the quality indexes of the tested objects, so that the rapid nondestructive detection and intelligent evaluation of food quality can be realized. This course covers food nondestructive detection techniques including computer vision, near-infrared spectroscopy, hyperspectral and multispectral imaging, fluorescence spectral imaging, biosensor detection, the latest international techniques in the same field, and the development trends and challenges. This course aims at helping students to understand the basic concepts, fundamental theories and technical principles of food nondestructive detection, to be familiar with various detection devices, and to master the characteristics and

application scenarios of various detection methods. And therefore, developing a foundation that can be used as the basis for further study and research in this field. It is expected that students can design new methods, develop new techniques, create new equipment and expand the application fields of nondestructive testing of food in intelligent food evaluation and intelligent control of food production process in the future.

**课程名称：**食品无损检测基础

**课程代码：**ES083200C1803

**I、计划学时：**48（实验：8 学时） 学分：3； 课程类别：核心专业课程

**开课学期：**春/秋 学期； **考核方式：**学术报告；

**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：**

**适用的学科：**食品科学与工程

**专业学位类别：**学术型硕士研究生

**III、预修课程：**

计算机应用基础，电子和电路，食品化学等

**IV、教学目的：**

本课程旨在帮助学生理解食品无损检测的基本概念、基础理论和技术原理，熟悉各种无损检测装置，掌握各种食品无损检测方法的特性和应用场景。为在本领域进一步学习和研究打下坚实基础。

**V、授课方式**

板书、PPT 教学、案例分析、实验

**VI、课程内容及学时分配、对学生的要求：**

第一章 绪论 （2 学时）

1. 背景介绍
2. 无损检测基本概念
3. 无损检测应用领域实例

**要求：**掌握食品无损检测基本理念，理解为什么要学食品无损检测、学习哪些内容、怎样学习食品无损检测技术。

第二章 计算机视觉技术原理及应用 （8 学时）

1. 计算机视觉技术的基本原理
2. 数字图像处理方法
3. 相关应用实例

**要求：**了解计算机视觉系统的基本组成和原理，了解数字图像处理的基本步骤和处理方法，熟悉食品质量相关计算机图像处理的工作原理和分析过程。

**实验：**机器视觉相关实验的操作方法讲解并演示。

### 第三章 近红外光谱检测技术原理及应用（8 学时）

1. 近红外光谱技术简介
2. 近红外光谱的分子振动机理
3. 近红外光谱检测方法
4. 相关应用示例

**要求：**了解近红外光谱的基本原理和分子振动机理；熟悉近红外光谱系统对不同状态食品的检测模式；了解近红外光谱技术的优缺点；熟悉近红外光谱的应用。

**实验：**了解近红外光谱仪器的基本操作，学会对不同状态的食品建立合适的近红外光谱检测方法。

### 第四章 高光谱成像及多光谱成像技术原理及应用（8 学时）

1. 光谱成像技术综述
2. 高光谱成像及多光谱成像原理
3. 光谱图像的特点及应用实例

**要求：**了解光谱成像技术的特点，光谱成像、光谱学和计算机视觉之间的关系。掌握高光谱成像系统的基本组成、成像原理。熟悉高光谱成像技术的分析流程和应用。

**实验：**讲解高光谱系统的硬件组成和操作过程，掌握高光谱图像采集和图像处理方法。

### 第五章 荧光光谱成像技术原理及应用（8 学时）

1. 荧光光谱成像技术的基本原理
2. 荧光光谱仪的基本原理和分析流程
3. 荧光分析技术的特点及相关应用

**要求：**了解荧光光谱成像技术原理；掌握荧光光谱成像技术的主要结构、工作原理和分析过程；熟悉荧光分析的特点和应用。

**实验：**讲解荧光系统的硬件组成和实验分析过程，介绍并演示如何使用荧光光谱成像技术检测食品中的化学污染物残留。

### 第六章 生物传感技术原理及应用（10 学时）

1. 生物传感器概述、原理和组件介绍
2. 生物传感器分类
3. 电化学和光学生物传感器
4. 生物传感器中的生物识别元件及其固定化
5. 相关应用示例

**要求：**了解生物传感技术的基础知识、原理以及组件类型；了解生物识别过程中的传感器检测机制；生物识别元件和固定技术的类型；概述主要的传导系统，重点是光学转导系统，基础电化学和生物传感器在电化学方法中的使用；掌握纳米技术及其在生物传感器分析设计中的应用；最后，掌握生物传感器在食品分析领域的实际应用。

**实验：**表面增强拉曼光学传感器检测食品中的化学污染物。



## 第七章 趋势与挑战（4 学时）

1. 发展趋势
2. 面临的挑战

**要求：**对食品无损检测技术现状有清晰的认识，培养对发展趋势的判断能力，对食品无损检测技术发展面临的挑战有正确的认识。

### 课时分配：

章节	教学	实验
第一章 绪论	2	
第二章 计算机视觉技术原理及应用	6	2
第三章 近红外光谱检测技术原理及应用	6	2
第四章 高光谱成像及多光谱成像技术原理及应用	6	2
第五章 荧光光谱成像技术原理及应用	6	2
第六章 生物传感技术原理及应用	10	
第七章 趋势与挑战	4	
汇总	40	8

## VII、教材及主要参考书和资料：

### 参考书：

1. Quansheng Chen, Hao Lin, Jiewen Zhao. Advanced Nondestructive Detection Technologies in Food [M]. Springer Singapore, 2021.
2. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing (4th Edition) [M]. Pearson, 2018.
3. Bosoon Park, Renfu Lu. Hyperspectral Imaging Technology in Food and Agriculture [M]. Springer New York, 2015.
4. Emil W. Ciurczak, Benoît Igne, Jerome Workman, Jr., Donald A. Burns. Handbook of Near-Infrared Analysis (4th Edition) [M]. CRC Press, 2021.
5. Ping Wang, Qingjun Liu, Chunsheng Wu, K. Jimmy Hsia. Bioinspired Smell and Taste Sensors [M]. Springer Dordrecht, 2015.
6. Yoon, Jeong-Yeol. Introduction to biosensors: from electric circuits to immunosensors. Springer, 2016.
7. Alpert, Nelson L. Theory and Practice of Infrared Spectroscopy [M]. Springer, 2013

### 参考资料：

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， 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， Journal of Sensory Studies， Journal of Food Engineering， Food Reviews International, Comprehensive Reviews in Food Science and Food Safety，

Analytical Methods, Food Analytical Methods

**VII、讲课教师:**

黄星奕、李欢欢、欧阳琴、王成全、田潇瑜、Waqas Ahmad

**IX、大纲撰写人:**

黄星奕、李欢欢

**Course name:** Basis for Food Nondestructive Detection Techniques

**Course code:** ES083200C1803

**I、Scheduled Teaching hours:** 48 (experiments: 8 hours) **credits:** 3; **Course type:** Core specialized course

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

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

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

Applicable discipline: Food Science and Engineering;

Professional degree category: Academic master

**III、Prerequisite course:**

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

**IV、Teaching objective:**

This course aims at helping students to understand the basic concepts, fundamental theories and technical principles of food nondestructive detection, to be familiar with various detection devices, and to master the characteristics and application scenarios of various detection methods. And therefore, developing a foundation that can be used as the basis for further study and research in this field.

**V、Teaching methods**

PPT teaching/case analysis/experiment

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

**Chapter 1 Introduction**

(2 credits hours)

1. Background
2. Basic concepts of nondestructive detection
3. Examples of fields that use nondestructive detection methods

**Requirements:** To have basic idea about food nondestructive detection, to understand why should learn, what

to learn and how to learn food nondestructive detection techniques.

## **Chapter 2 Principle and Application of Computer Vision Technology**

**(8 credits hours)**

1. Basic principles of computer vision technology
2. Method of digital image processing
3. Examples of related application

**Requirements:** Understand the basic composition and principle of computer vision system, understand the basic steps and processing methods of digital image processing, and be familiar with the working principle and analysis process of computer image processing for food quality.

**Experiments :** The Operation methods of machine vision related experiments are explained and demonstrated.

## **Chapter 3 Principle and Application of Near Infrared Spectroscopy Technology**

**(8 credits hours)**

1. Overview of near-infrared spectroscopy technology
2. Molecular vibration mechanism of near infrared spectroscopy
3. Advantages/disadvantages of near infrared spectroscopy
4. Examples of related application

**Requirements:** Understand the basic principles and molecular vibration mechanism of near infrared spectroscopy; familiar with different detection modes using near infrared spectroscopy system for different states of food; understand the advantages/disadvantages of near infrared spectroscopy; familiar with the application of near infrared spectroscopy.

**Experiments:** Understand the basic operation of near infrared spectroscopy instrument, learn to establish a suitable near infrared spectroscopy detection method for food in different states.

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

**(8 credits hours)**

1. Overview of spectral imaging technology
2. The principle of hyperspectral imaging multi-spectral imaging
3. The characteristics and related application of spectral image

**Requirements:** Understand the characteristics of spectral imaging technology, the relationship between spectral imaging, spectroscopy and computer vision. Master the basic components, image forming principle of hyperspectral imaging system. Familiar with the analysis process and application of hyperspectral imaging technology.

**Experiments:** Explain the hardware composition and experimental operation process of hyperspectral system, and introduce the methods of hyperspectral image acquisition and image processing.

## **Chapter 5 Principle and Application of Fluorescence Spectral Imaging Technology**

**(8 credits hours)**

1. Basic principles of fluorescence spectral and imaging technology
2. Basic principle and analysis flow of fluorescence spectrometer
3. The characteristics and application of fluorescence analysis

**Requirements:** Understand the principle of fluorescence spectral imaging technology; Master the main structure, working principle and analysis process of fluorescence spectral imaging technology; Familiar with the characteristics and application of fluorescence analysis.

**Experiments:** Explain the hardware composition and experimental analysis process of the fluorescence system; introduce and demonstrate how to use fluorescence spectral imaging technology to detect chemical pollutant residues in food.

## Chapter 6 Principle and Application of Biosensor Technology

(10 credits hours)

1. Introduction to biosensors, principle and components
2. Classification of biosensors based on transducers
3. Electrochemical and optical biosensors
4. Biorecognition elements in a biosensors and its immobilization
5. Examples of related application

**Requirements:** Understand the basics and principles of biosensors technology and the type of components. Learn detection mechanisms in the course of a biorecognition event. Types of biorecognition elements and immobilization techniques, overview on the main transduction systems with a focus on optical transduction systems, basic electrochemistry and the use of biosensors in an electrochemical method. Master the nanotechnology and its use in the design of biosensor assays. Finally, implementing real applications of the techniques in the field of biosensors for food analysis.

## Chapter 7 Trends and Challenges

(4 credits hours)

1. Trends
2. Challenges

**Requirements:** To have a clear idea of the state of the art in food nondestructive detection, to develop the ability to judge the trend of development, to have a correct understanding of the challenges faced.

### Class Hour Distribution:

Chapters	Teaching hours	Experiments
Chapter 1 Introduction	2	
Chapter 2 Principle and Application of Computer Vision Technology	6	2
Chapter 3 Principle and Application of Near Infrared Spectroscopy Technology	6	2

Chapter 4 Principle and Application of Hyper and Multi-Spectral Imaging Technology	6	2
Chapter 5 Principle and Application of Fluorescence Spectral Imaging Technology	6	2
Chapter 6 Principle and Application of Biosensor Technology	10	
Chapter 7 Trends and Challenges	4	
<b>Total</b>	<b>40</b>	<b>8</b>

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

### Main Reference books:

1. Quansheng Chen, Hao Lin, Jiewen Zhao. Advanced Nondestructive Detection Technologies in Food [M]. Springer Singapore, 2021.
2. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing (4th Edition) [M]. Pearson, 2018.
3. Bosoon Park, Renfu Lu. Hyperspectral Imaging Technology in Food and Agriculture [M]. Springer New York, 2015.
4. Emil W. Ciurczak, Benoît Igne, Jerome Workman, Jr., Donald A. Burns. Handbook of Near-Infrared Analysis (4th Edition) [M]. CRC Press, 2021.
5. Ping Wang, Qingjun Liu, Chunsheng Wu, K. Jimmy Hsia. Bioinspired Smell and Taste Sensors [M]. Springer Dordrecht, 2015.
6. Yoon, Jeong-Yeol. Introduction to biosensors: from electric circuits to immunosensors. Springer, 2016.
7. Alpert, Nelson L. Theory and Practice of Infrared Spectroscopy [M]. Springer, 2013

### Other reference materials:

Recent academic papers published in related fields

Recommend a number of authoritative international academic journals (but not limited to this): 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, Journal of Sensory Studies, Journal of Food Engineering, Food Reviews International, Comprehensive Reviews in Food Science and Food Safety, Analytical Methods, Food Analytical Methods

## VII、Lecture(s):

Huang Xingyi, Li Huanhuan, Ouyang Qin, Wang Chengquan, Tian Xiaoyu, Waqas Ahmad

## IX、Responsible for syllabus design:

Huang Xingyi, Li Huanhuan

## 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、勇于担当社会主义核心价值观。

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

# 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<sub>2</sub>) (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. Principles 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<sub>2</sub>) 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. Principles 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装备

课程名称:现代物理加工技术与装备

学分: 2

教学学时: 32

教学大纲内容:

现代物理加工技术与装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

#### IV、教学目的:

本课程的目的: (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:

<b>第一章 超声波技术与设备</b>	<b>(6 学时)</b>
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	
<b>第二章 分离技术与设备</b>	<b>(4 学时)</b>
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	
<b>第三章 红外技术与设备</b>	<b>(6 学时)</b>
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	
<b>第四章 分析技术与设备</b>	<b>(4 学时)</b>
1. 介绍分析技术和使用过的设备	
2. 应用案例:质谱	
<b>第五章 微波技术与设备</b>	<b>(2 学时)</b>
1. 介绍微波技术和使用过的设备	
2. 微波应用案例	
<b>第六章 射频技术与设备</b>	<b>(2 学时)</b>
1. 介绍射频技术和使用过的设备	
2. 射频应用案例	
<b>第七章 电场技术与设备</b>	<b>(4 学时)</b>
1. 介绍电场技术和使用过的设备	
2. 电场应用案例	
<b>第八章 低温等离子体技术与设备</b>	<b>(2 学时)</b>
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)**

**VII、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.

**VII、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：食品物理加工科学专题**

**课程名称：**食品物理加工科学

**学分：**2

**学时：**32

**教学内容：**

这门课程的教学目标是给学生提供食品物理加工技术的基础知识。通过一系列专题的学习与讨论，学生应当能够知晓常见的食品物理加工技术的原理；学生应当能够解释在实时实验中出现的科学现象；学生应当能够选择合适的物理加工技术，并应用到他们的硕士研究当中（如有必要）。总而言之，这门课程的核心内容涵盖了广域的食品物理加工技术。课程也做到了理论与实际应用的关联。

这门课程包含一个领域介绍专题和 8 个特定技术专题（总计 32 课时），具体包括：1. 领域介绍（4 课时）；2. 微波与射频加工技术（2 课时）；3. 辐照加工技术（2 课时）；4. 电场加工技术（2 课时）；5. 红外加工技术与实验（4+2 课时）；6. 超声波加工技术与实验（4+2 课时）；7. 脉冲强光加工技术与实验（4+2 课时）；8. 物理场对微生物代谢特性的影响：研究与发展近况（2 课时）；9. 等离子体加工技术（2 课时）。这门课程的每个组成部分都对应一种食品物理加工技术。由于空间和设备的限制，只有三种食品物理加工技术被分配了实时的课程实验。这三个课程实验对应了我们学院里食品物理加工技术最强的领域。事实上，很多学生将来会在他们的研究课题中使用超声、红外或者脉冲强光。这门课程尤其适合那些做食品加工、食品保藏和功能性食品组分提取的学生。

## **Introduction of the Course: Special Topics of Food Physics Processing Science**

**Course Name:** Special Topics of Food Physics Processing Science

**Credit:** 2

**Teaching hours:** 32

**Contents of the Syllabus:**

This course aims at providing the underpinning knowledge of food physical processing technologies. With the study and discussion of a series of special topics, students should be able to understand the principles of the commonly reported food physical processing technologies; students should be able to explain the science of common phenomenon during the real-time practical experiment; students should be able to select proper physical processing technologies and apply them in their master's study (if necessary). Overall, the content of this course covers a wide

range of food processing technologies. It also crosslinks theories to practical applications.

This course contains an introduction seminar and 8 specific sections (in total of 32 teaching hours), including: 1. Introduction (4 teaching hours); 2. Microwave and radio frequency processing (2 teaching hours); 3. Irradiation processing (2 teaching hours); 4. Electrical field processing (2 teaching hours); 5. Infrared red processing with a practical experiment (4+2 teaching hours); 6. Ultrasonic processing with a practical experiment (4+2 teaching hours); 7. Pulsed visible light and ultraviolet light processing with a practical experiment (4+2 teaching hours); 8. Effect of physical field on the metabolic characteristics of microorganisms: Recent studies and developments (2 teaching hours); 9. Plasma processing technology (2 teaching hours). Each section of this course represents a type of food physical processing technology. Due to the restrictions of room and equipment, only 3 types of food physical processing technologies are associated with a real-time practical experiment. These three practical sections are the most pronounced food physical processing research fields in our school. In fact, many students will be applying ultrasound, infrared red, pulsed visible light in their own research studies. This course is especially suitable for the students doing food processing, food preservation and functional food ingredient extraction.

## **课程名称:食品物理加工科学专题**

**课程代码: ES083200D1813**

**I、课时分配:** 32 (实验: 6 hours) **学分:** 2; **课程类型:** 专业选修;

**开课学期:** 春季学期; **考核方法:** 学术报告;

**开放学院:** 食品与生物工程学院

**II、可申请的学科以及专业选修类型:**

这门课程对食品科学学科(食品与生物工程学院)的学生开放申请。课程为研究生专业选修课程设计。

**III、前置课程:**

无需前置课程

**IV、教学目标:**

这门课程的教学目标是给学生提供食品物理加工技术的基础知识。通过一系列专题的学习与讨论,学生应当能够知晓常见的食品物理加工技术的原理;学生应当能够解释在实时实验中出现的科学现象;学生



应当能够选择合适的物理加工技术，并应用到他们的硕士研究当中（如有必要）。总而言之，这门课程的核心内容涵盖了广域的食品物理加工技术。课程也做到了理论与实际应用的关联。

#### V、教学方法：

传统授课法，特例讨论法，示范法，实验操作法。

#### VI、课程内容、课时分配以及对学生的要求：

这门课程包含一个领域介绍专题和 8 个特定技术专题（总计 32 课时），具体包括：1.领域介绍 (4 课时); 2. 微波与射频加工技术 (2 课时); 3. 辐照加工技术 (2 课时); 4. 电场加工技术 (2 课时); 5. 红外加工技术与实验 (4+2 课时); 6. 超声波加工技术与实验 (4+2 课时); 7. 脉冲强光加工技术与实验 (4+2 课时); 8. 物理场对微生物代谢特性的影响：研究与发展近况 (2 课时); 9. 等离子体加工技术 (2 课时)。这门课程的每个组成部分都对应一种食品物理加工技术。由于空间和设备的限制，只有三种食品物理加工技术被分配了实时的课程实验。这三个课程实验对应了我们学院里食品物理加工技术最强的领域。事实上，很多学生将来会在他们的研究课题中使用超声、红外或者脉冲强光。这门课程尤其适合那些做食品加工、食品保藏和功能性食品组分提取的学生。

No	课程内容	课时	授课人
1	领域介绍	4	Fakayode Olugbenga
2	微波加工技术	2	王博
3	辐照加工技术	2	王博
4	电场加工技术	2	王博
5	红外加工技术	4	吴本刚
6	红外加工技术课程实验	2	吴本刚
7	超声波加工技术	4	徐保国
8	超声波加工技术课程实验	2	徐保国
9	脉冲强光与紫外加工技术	4	张磊
10	脉冲强光与紫外加工技术课程实验	2	张磊
11	物理场对微生物代谢特性的影响：研究与发展趋势	2	张荣
12	等离子体加工技术	2	高献礼

#### VII、教学材料、主要的参考书以及其它的参考材料

**教学材料:**

**Office PowerPoint, 课程实验平台, 腾讯视频 (voov).**

**参考书:**

- [1] Daniela Bermudez-Aguirre. Ultrasound: advances in food processing and preservation[M].Academic Press, an imprint of Elsevier,2017.
- [2] Zhongli Pan, Griffiths Gregory Atungulu.Infrared heating for food and agricultural process[M].Jobs press,2011.
- [3]贾敬敦, 马海乐, 葛毅强, 魏珣著.食品物理加工技术与装备发展战略研究[M].北京: 科学出版社,2016.
- [4]丘泰球, 任娇艳, 杨日福主编.食品物理加工技术[M].北京: 科学出版社,2018.
- [5]胡爱军, 郑捷主编.食品超声技术[M].北京: 化学工业出版社,2013.

**其它参考材料:**

- 1. Tianfei Dong. Food Physical Processing Technology and its Basic Framework[J]. E3S Web of Conferences, 2020, Vol. 185: 4037.
- 2. Pan, Jiayin et al., Effects of nonthermal physical processing technologies on functional, structural properties and digestibility of food protein: A review[J]. Journal of Food Process Engineering, 2022, Vol. 45(4).
- 3. Ravi et al. Research trends and emerging physical processing technologies in mitigation of pesticide residues on various food products[J]. Environmental Science and Pollution Research, 2022, Vol. 29(30): 45131-45149.
- 4. Fan, DM et al. Green Physical Processing Technologies for the Improvement of Food Quality. [J]. Journal of Food Quality, 2018, Vol. 2018: 1-2
- 5. Cunshan Zhou et al. Ultrasound, infrared and its assisted technology, a promising tool in physical food processing: A review of recent developments[J]. Critical Reviews in Food Science and Nutrition, 2021, Vol: 1-25.

**VII、任课老师:** 王博, 周存山, Fakayode Olugbenga, 吴本刚, 徐保国, 张磊, 张荣, 高献礼

**IX、课程设计负责人:** 课程主要设计者为王博, 课程设计的可执行情况与其他任课老师进行了正式的讨论。

**Course name: Special Topics of Food Physics Processing Science**

**Course code: ES083200D1813**

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

This course is applicable for the students who are in the field of food science (School of food and biological engineering). The course is designed for the master's study.

## **III 、 Prerequisite course:**

No requirement

## **IV 、 Teaching objective:**

This course aims at providing the underpinning knowledge of food physical processing technologies. With the study and discussion of a series of special topics, students should be able to understand the principles of the commonly reported food physical processing technologies; students should be able to explain the science of common phenomenon during the real-time practical experiment; students should be able to select proper physical processing technologies and apply them in their master's study (if necessary). Overall, the content of this course covers a wide range of food processing technologies. It also crosslinks theories to practical applications.

## **V 、 Teaching methods**

Traditional lecture method, Specific case discussion, Demonstration, Practical experiments.

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

This course contains an introduction seminar and 8 specific sections (in total of 32 teaching hours), including:

1. Introduction (4 teaching hours);
2. Microwave and radio frequency processing (2 teaching hours);
3. Irradiation processing (2 teaching hours);
4. Electrical field processing (2 teaching hours);
5. Infrared red processing with a practical experiment (4+2 teaching hours);
6. Ultrasonic processing with a practical experiment (4+2 teaching hours);
7. Pulsed visible light and ultraviolet light processing with a practical experiment (4+2 teaching hours);
8. Effect of physical field on the metabolic characteristics of microorganisms: Recent studies and developments (2 teaching hours);
9. Plasma processing technology (2 teaching hours).

No	Contents	Hours	Assignments
1	Introduction	4	Fakayode Olugbenga
2	Microwave and radio frequency processing	2	Bo Wang
3	Irradiation processing	2	Bo Wang
4	Electrical field processing	2	Bo Wang
5	Infrared red processing	4	Bengang Wu
6	Practical experiment for infrared red processing	2	Benguang Wu
7	Ultrasonic processing	4	Boguo Xu
8	Practical experiment for ultrasonic processing	2	Baoguo Xu
9	Pulsed visible light and ultraviolet light processing	4	Lei Zhang
10	Practical experiment for Pulsed visible light and ultraviolet light processing	2	Lei Zhang
11	Effect of physical field on the metabolic characteristics of microorganisms: Recent studies and developments	2	Rong Zhang
12	Plasma processing technology	2	Xianli Gao

Each section of this course represents a type of food physical processing technology. Due to the restrictions of room and equipment, only 3 types of food physical processing technologies are associated with a real-time practical experiment. These three practical sections are the most pronounced food physical processing research fields in our school. In fact, many students will be applying ultrasound, infrared red, pulsed visible light in their own research studies. This course is especially suitable for the students doing food processing, food preservation and functional food ingredient extraction.

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

### **Teaching material:**

Office PowerPoint, Practical laboratory, Tencent meeting (Voov) platform.

### **Reference books:**

- [1] Daniela Bermudez-Aguirre. Ultrasound: advances in food processing and preservation[M]. Academic Press, an imprint of Elsevier, 2017.
- [2] Zhongli Pan, Griffiths Gregory Atungulu. Infrared heating for food and agricultural process[M]. Jobs

press,2011.

[3]贾敬敦, 马海乐, 葛毅强, 魏珣著.食品物理加工技术与装备发展战略研究[M].北京: 科学出版社,2016.

[4]丘泰球, 任娇艳, 杨日福主编.食品物理加工技术[M].北京: 科学出版社,2018.

[5]胡爱军, 郑捷主编.食品超声技术[M].北京: 化学工业出版社,2013.

#### **Other reference materials:**

1. Tianfei Dong. Food Physical Processing Technology and its Basic Framework[J]. E3S Web of Conferences, 2020, Vol. 185: 4037.
2. Pan, Jiayin et al., Effects of nonthermal physical processing technologies on functional, structural properties and digestibility of food protein: A review[J]. Journal of Food Process Engineering, 2022, Vol. 45(4).
3. Ravi et al. Research trends and emerging physical processing technologies in mitigation of pesticide residues on various food products[J]. Environmental Science and Pollution Research, 2022, Vol. 29(30): 45131-45149.
4. Fan, DM et al. Green Physical Processing Technologies for the Improvement of Food Quality. [J]. Journal of Food Quality, 2018, Vol. 2018: 1-2
5. Cunshan Zhou et al. Ultrasound, infrared and its assisted technology, a promising tool in physical food processing: A review of recent developments[J]. Critical Reviews in Food Science and Nutrition, 2021, Vol: 1-25.

**VII、Lecture(s): Bo Wang, Cunshan Zhou, Fakayode Olugbenga, Bengang Wu, Baoguo Xu, Lei Zhang, Rong Zhang, Xianli Gao**

**IX、Responsible for syllabus design: The syllabus of this course is designed by Bo Wang with a formal discussion of all the collaborated lectures.**

## 《食品生物技术前沿进展》课程简介

**课程名称：**食品生物技术前沿进展

**课程代码：**ES083200D1813

**授课对象：**食品科学与工程硕士研究生；生物医药硕士研究生。

**学 分：**2

**学 时：**32

**课程内容：**

社会和科技快速发展，人们对食品的需求已从基本的“保障供给”转向了“营养健康”，迫切需要采用新技术、新工艺来满足食品安全性、营养价值和生产可持续性需求。当前，合成生物学、基因组编辑技术、计算机辅助设计、人工智能和仿生制造等现代生物前沿交叉技术创新不断涌现，在食品加工和生产领域逐渐得到应用。食品生物技术是食品科学与现代生物技术的有效结合，有利于改善传统的食品生产和制造方式和提高食品的营养并增加新的功能。食品生物技术前沿进展是一门旨在提高研究生独立科研能力和开阔视野的课程。通过本课程的学习，使学生系统掌握现代生物学技术与食品科学及食品工业相关的知识体系，了解国内外食品生物技术领域的主要研究方向、研究热点以及发展趋势，认识现代生物前沿交叉技术对食品加工和食品营养与安全学科的重要性和发展潜力，了解生物科研“卡脖子”领域，培养分析和解决食品生物技术领域问题的能力，熟悉“自主创新、核心科技”和“工匠精神”的内涵，树立“科技兴国”的理想信念，为将来从事生产和科研工作打下坚实的基础。

### **Introduction of the Course: Advances in Food Biotechnology**

**Course Name:** Advances in Food Biotechnology

**Credit:** 2

**Teaching hours:** 32

**Contents of the Syllabus:**

With the rapid development of society and science and technology, people's demand for food has shifted from basic "guaranteed supply" to "nutritious health", and it is urgent to adopt new technologies and processes to meet the needs of food safety, nutritional value and production sustainability. At present, modern biological frontier and cross-technological innovations such as synthetic biology, genome editing technology, computer-aided design, artificial intelligence and biomimetic manufacturing are constantly emerging, which are gradually applied in the food processing and production fields. Food biotechnology is an effective combination of food science and modern

biotechnology, which is conducive to improving traditional food production and manufacturing methods, improving food nutrition and adding new functions. Advances in Food Biotechnology is a course designed to improve graduate students' independent research capabilities and broaden their horizons. Through the study of this course, students can systematically master the knowledge system related to modern biological technology and food science and food industry, understand the main research directions, research hotspots and development trends in the field of food biotechnology at home and abroad, and understand the impact of modern biological cutting-edge cross-technology on the importance and development potential of food processing and food nutrition and safety disciplines, understand the "stuck neck" field of biological scientific research, cultivate the ability to analyze and solve problems in the field of food biotechnology, and be familiar with the Connotations including "independent innovation, core technology" and "artisan spirit" Connotation, establish the ideal and belief of "rejuvenating the country with science and technology", and lay a solid foundation for future production and scientific research work.

## 《食品生物技术前沿进展》教学大纲

**Course name: Advances in Food Biotechnology**

**课程代码: ES083200D1813**

**Course code: ES083200D1813**

I、计划学时: 32 (其中实验 0 学时); 学分: 2; 课程类别: 专业选修课; 开课学期: 第 2 学期; 考核方式: 综述报告; 开课单位: 食品与生物工程学院;

I、Scheduled Teaching hours: 32 (experiments: 0 hours) credits: 2; Course type: Specialized Elective;

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

Opening unit: School of Food and Biological Engineering

II 授课对象: 食品科学与工程硕士研究生; 生物医药硕士研究生.

II、Applicable disciplines and professional degree categories:

Food Science and Engineering; Biology and Medicine

III、先修课程: 生物化学、微生物学、发酵工艺学、分子生物学、基因工程

III、Prerequisite course:

Biochemistry; Microbiology; Fermentation technology; Molecular biology; Genetic engineering; Cell engineering

#### IV、教学目的

通过本课程的学习，使学生系统掌握现代生物学技术与食品科学及食品工业相关的知识体系，了解国内外食品生物技术领域的主要研究方向、研究热点以及发展趋势，认识现代生物前沿交叉技术对食品加工和食品营养与安全学科的重要性和发展潜力，了解生物科研“卡脖子”领域，培养分析和解决食品生物技术领域问题的能力，熟悉“自主创新、核心科技”和“工匠精神”的内涵，树立“科技兴国”的理想信念，为将来从事生产和科研工作打下坚实的基础。

#### IV、Teaching objective:

Through the study of this course, students can systematically master the knowledge system related to modern biological technology and food science and food industry, understand the main research directions, research hotspots and development trends in the field of food biotechnology at home and abroad, and understand the impact of modern biological cutting-edge cross-technology on the importance and development potential of food processing and food nutrition and safety disciplines, understand the "stuck neck" field of biological scientific research, cultivate the ability to analyze and solve problems in the field of food biotechnology, and be familiar with the Connotations including "independent innovation, core technology" and "artisan spirit" Connotation, establish the ideal and belief of "rejuvenating the country with science and technology", and lay a solid foundation for future production and scientific research work.

#### V、教学方式

采用线上线下混合、案例分析与讨论、分组研讨分析等教学方法。

#### V、Teaching methods

Class lectures; Case analysis; Discussion

#### VI、课程内容、学时分配

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

##### 第一讲 食品微生物资源与应用研究进展 (6 学时)

##### (一)、课程内容和学时分配

1. 食品中常见的微生物 (2 学时)
2. 目的菌株的获得 (2 学时)
3. 高生产性能菌株选育 (2 学时)

##### (二)、目的和要求

1. 熟悉食品生产中常见的细菌、真菌、噬菌体等微生物。
2. 掌握目的菌株的分离、鉴定以及高性能生产菌株的选育等关键技术。

##### Lecture 1: Research progress on food microbial resources and applications (6 credits)

##### Class hour distribution:

1. Common microorganisms in foods (2 credits)
2. Obtaining the target strain (2 credits)
3. Breeding of strains with high production performance (2 credits)

##### Requirements for students:



1. Familiar with bacteria, fungi, bacteriophages and other microorganisms commonly found in food production.

2. Master key technologies such as the isolation and identification of target strains and the selection and breeding of high-performance production strains.

## **第二讲 食源性致病菌作用机制与防控** ( 4 学时)

(一)、课程内容和学时分配

1. 常见食源性致病菌的分类特点和作用机制 ( 2 学时)

2. 食源性致病菌防控前沿技术及其在食品工业中的应用 ( 2 学时)

(二)、目的和要求

1. 掌握常见食源性致病菌的分类方法及其特点。

2. 熟悉食源性致病菌在食品工业中的危害和防控策略。

## **Lecture 2: Application of extreme microorganisms in food industry** ( 4 credits)

### **Class hour distribution:**

1. Classification and characteristics of extreme microorganisms (2 credits)

2. Research frontiers of extreme microbes and their applications in the food industry (2 credits)

### **Requirements for students:**

1. Master the classification methods and characteristics of common foodborne pathogens.

2. Familiar with the hazards and control strategies of foodborne pathogens in the food industry.

## **第三讲 食品发酵技术研究现状与进展** ( 6 学时)

(一)、课程内容和学时分配

1. 新型食品发酵技术的发展 ( 2 学时)

2. 食品发酵技术的几个关键问题 ( 2 学时)

3. 食品发酵技术研究案例 ( 2 学时)

(二)、目的和要求

1. 掌握现代食品发酵技术研究领域研究现状和前沿技术。

2. 熟悉食品发酵技术中关注的核心问题。

## **Lecture 3: Research status and progress of food fermentation technology** ( 6 credits)

### **Class hour distribution:**

1. Research status and progress of food fermentation technology (2 credits)

2. Several key issues of food fermentation technology (2 credits)

3. Food fermentation technology research case (2 credits)

### **Requirements for students:**

1. Master the research status and cutting-edge technologies in the field of modern food fermentation technology.

2. Familiar with the core issues of food fermentation technology.

## **第四讲 食品科学中的组学** ( 4 学时)

(一)、课程内容和学时分配

1. 酶学在食品生物技术研究中的应用 ( 2 学时)
2. 组学及其在食品生物技术研究中的应用 ( 2 学时)

(二)、目的和要求

1. 掌握食品酶学的研究方法和前沿技术。
2. 熟悉组学的理论基础及其在食品生物技术研究中的应用策略。

**Lecture 4: Omics in food science ( 4 credits)**

**Class hour distribution:**

1. Application of enzymology in food biotechnology research (2 credits)
2. Omics y and their application in food biotechnology research (2 credits)

**Requirements for students:**

1. Master the research methods and cutting-edge technologies of food enzymology.
2. Familiar with the theoretical basis of omics and its application strategies in food biotechnology research

**第五讲 食品合成生物学 ( 6 学时)**

(一)、课程内容和学时分配

1. 合成生物学 ( 2 学时)
2. 食品合成生物学的应用 ( 4 学时)

(二)、目的和要求

1. 掌握食品合成生物学的研究方法和关键技术。
2. 熟悉合成生物学的理论基础及其再食品生物技术研究中的应用策略。

**Lecture 5: Synthetic biology in food science ( 6 credits)**

**Class hour distribution:**

1. Synthetic biology ( 2 credits)
2. Applications of food synthetic biology (4 credits)

**Requirements for students:**

1. Master the research methods and key technologies of food synthetic biology
2. Familiar with the theoretical basis of synthetic biology and its application strategies in re-food biotechnology research

**第六讲 典型发酵食品工业生产现状与趋势 ( 6 学时)**

(一)、课程内容和学时分配

1. 典型的传统发酵产品、生产关键技术及研究现状 ( 2 学时)
2. 我国现代发酵产品、生产关键技术及发展趋势 ( 4 学时)

(二)、目的和要求

1. 熟悉传统发酵产品生产的理论基础。
2. 熟悉现代发酵产业的优势和发展趋势。

**Lecture 6: Production status and trend of typical fermented food industry (6 credits)**

**Class hour distribution:**

1. Typical traditional fermentation products and production status (2 credits)

2. The current situation and development trend of modern fermentation industry (**4 credits**)

**Requirements for students:**

1. Master the research methods and key technologies of food synthetic biology
2. Familiar with the theoretical basis of synthetic biology and its application strategies in re-food biotechnology research

**VII、参考书目及学习资料**

**教材:** 食品微生物功能调控与优化, 陈坚, 化学工业出版社, 2011, 第 1 版。

**参考书:** Novel Food Fermentation Technologies, Edited by Ojha, K. Shikha, Tiwari, Brijesh K.. Published in 2016 by Springer Press. Fermentation Processes Engineering in the Food Industry, Edited by Carlos Ricardo Soccol, Ashok Pandey and Christian Larroche. Published in 2013 by CRC Press.

**必读参考资料:** 相关领域的国际权威学术期刊, 包括 Science、Nature、Nature Biotechnology、Nature Reviews Microbiology、Annual Review of Microbiology、Nature Communications、Current Opinion in Microbiology、Food Microbiology、International Journal of Food Microbiology、International Journal of Systematic and Evolutionary Microbiology、Metabolic Engineering 等。

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

**Teaching material:** Food microbial function regulation and optimization, Chen Jian, Published in 2011 by Chemical Industry Press.

**Reference books:** Novel Food Fermentation Technologies, Edited by Ojha, K. Shikha, Tiwari, Brijesh K.. Published in 2016 by Springer Press. Fermentation Processes Engineering in the Food Industry, Edited by Carlos Ricardo Soccol, Ashok Pandey and Christian Larroche. Published in 2013 by CRC Press.

**Other reference materials:** Top journals in food and biological fields including Science, Nature, Nature Biotechnology, Nature Reviews Microbiology, Annual Review of Microbiology, Nature Communications, Current Opinion in Microbiology, Food Microbiology, International Journal of Food Microbiology, International Journal of Systematic and Evolutionary Microbiology, Metabolic Engineering.

**VII、授课教师:**

崔凤杰, 齐向辉, Zabed M Hossain, 孟利娟, 赵梅

**VII、Lecture(s):**

Cui FengJie, Qi XiangHui, Zabed M Hossain, Meng LiJuan, Zhao Mei

**IX、大纲撰写人**

崔凤杰

**IX、Responsible for syllabus design:**

Cui FengJie

## 《食品安全科学专题》课程简介

**课程名称：**食品安全科学专题

**课程代码：**

**授课对象：**食品科学与工程

**学 分：**2

**学 时：**32 学时

**课程内容：**

食品安全与消费者的身体健康和生命安全息息相关。食品安全状况成为人民共同关心的热点问题。重视食品安全，已经成为衡量一个国家的人民的生活水平，社会稳定，法律建设的重要方面。当前中国食品安全存在的主要问题为病原微生物污染、农药兽药滥用、重金属/真菌毒素的污染，非法添加和掺杂使假。

《食品安全科学专题》是食品科学与工程专业的一门专业选修课，通过该门课程的学习，使学生了解食品安全的危害方面的最新研究热点以及发展趋势，掌握食品质量安全控制与检测领域的核心技术与方法，提高学生的实践能力与创新能力，为从事本学科领域相关科学研究、技术开发和新产品研制等工作奠定理论基础和提供基本技术方法。

## Introduction of the Course: Special theme on food safety and science

**Course Name:** Special theme on food safety and science

**Course Code:**

**Credit:** 2

**Teaching hours:** 32

**Contents of the Syllabus:**

Food safety is closely related with the health and life of consumers, which has become a hot issue of common concerns among the people. At present, the main problems of food safety in China are the pathogenic contamination, abuse of pesticides/veterinary drugs, heavy metals/fungal toxins contamination and the addition of illegal additives.

The course of “special theme on food safety and science” is an optional course for the major of food science and technology. Through the study of this course, students can understand the latest research hotspots and development trends of food safety issues. In addition, after studying this course,

students can learn the core technologies and methods in the field of food safety and quality control, along with the improvement of practical and innovative ability. The study of this course can provide the theoretical foundation and basic technical methods for scientific research, technological development and new products exploitation.

## 《食品安全科学专题》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 ， 学硕 ；

课程名称： 食品安全科学专题 ；

(英文名称)： Special theme on food safety and science ；

课程代码： ES083200D1816 ； 学分： 2 ； 计划学时： 32 （其中实验 0 学时）；

课程类别： 专业选修课 ； 开课学期： 第 I 学期； 开课单位： 食品与生物工程学院；

先修课程： 微生物学、食品微生物学、生物化学、食品卫生学、食品毒理学、食品安全学、食品化学、食品分析、食品工艺学等。

### 二、教学目的

通过对食品安全科学专题的学习，能够使本专业硕士研究生了解本学科领域食品安全科学技术的主要研究进展情况，尤其是针对当前中国食品安全存在的主要问题，了解病原微生物、农药兽药、真菌毒素、重金属、食品添加剂对食品安全的危害方面的研究热点以及发展趋势，掌握食品安全质量控制与检测领域研究的核心技术与方法，为从事本学科领域相关科学研究、技术开发和新产品研制等工作奠定理论基础和提供基本技术方法。

通过本课程的学习，能分析和评价食品安全对社会、健康、安全、法律、文化的影响，并理解应承担的责任。通过了解我国食品安全问题及现状，使学生树立正确的认知观、科学的发展观，树立民族自信心、激发爱国热情。思政重点是引导学生从多个角度看问题，引导学生把我国的食品安全问题放在世界范围内看，让学生认识到，引导学生把食品安全问题与食品工业发展阶段做对比，进而增强学生民族自信心和爱国热情。

### 三、教学方式

本课程的主要教学方法为教授法、任务驱动法和自主学习法。

#### 案例一、进行食源性致病菌特性的总结

在讲授“食源性致病菌对食品的污染”时，结合任务驱动法。首先，在上一堂课结束时，任课老师提出问题：主要的食源性致病菌有哪些？其生物学特性如何？污染的食品主要包括哪些？中毒机制主要是什么？并将学生分为四组，课后查阅相关资料，每组以其中一种致病菌为对象，共同完成上述问题。于本专

题讲授前，由每组派代表对上述任务查阅以及总结情况进行汇报。

#### 案例二、分析农产品采后储存的病虫危害

在“农产品采后病害的生物防治技术”这一专题结束后，由任课老师给每组的学生布置任务：威胁农产品采后储存的微生物主要有哪些？引起农产品腐败的机理是什么？常用的生物防治手段有哪些？学生需要在课后整理资料和研讨，并推举代表于下次上课时汇报文献查阅以及总结情况。

### 四、课程内容、学时分配

#### （一）课程内容

本课程首先概述当前我国食品安全中存在的主要问题，另外包括致病微生物对食品的污染及其绿色控制技术、农产品采后病害和真菌毒素污染及其生物防治技术、转基因食品安全性及其评价体系、食品化学性污染及其检测和控制方法四个专题。

#### （二）学时分配

##### 第一章 食源性致病菌对食品的污染及控制技术（8 学时）

1. 食源性致病菌对食品的污染（4 学时）
2. 食品中致病微生物的绿色控制技术（4 学时）

##### 第二章 真菌毒素对食品的污染及控制技术（10 学时）

1. 真菌及其真菌毒素对食品的污染（4 学时）
2. 食品中真菌及其真菌毒素的绿色控制技术（6 学时）

##### 第三章 化学性危害对食品的污染及控制技术（14 学时）

1. 农药兽药对食品的污染及控制技术（4 学时）
2. 有害金属对食品的污染及控制技术（4 学时）
3. 有害化合物对食品的污染及控制技术（2 学时）
4. 食品添加剂对食品的污染及控制技术（2 学时）
5. 容器及包装材料对食品的污染及控制技术（2 学时）

### 五、课程考核

序号	考核方式或途径	考核要求	考核权重
1	平时作业	主要考核学生对食源性致病菌和真菌毒素对食品的污染及控制技术的掌握	20%
2	小组研讨	小组 PPT 汇报，回答问题、提问等情况，按 100 分制评分。	20%
3	期末测试	开卷，提交结课报告： 卷面成绩 100 分。卷面成绩按比例计入课程总评成绩。	60%
总评成绩			100%

## 六、参考书目及学习资料

本课程尚无固定教材，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、Trends in Food Science & Technology、Journal of Agricultural and Food Chemistry、Food Chemistry、Food Control、International Journal of Food Microbiology、Food Microbiology、Journal of Functional Foods、Food & Function、Journal of Dairy Science、Biofouling、LWT-Food Science and Technology、Journal of Food Engineering、Food Packaging and Shelf Life 等。

## 七、大纲说明

无。

大纲撰写人：崔海英、史册

**Course name:** Special theme on food safety and science

**Course code:** ES083200D1816

### I 、 Basic information

**Applicable disciplines and professional degree categories:** Food Science and Engineering, Academic Master's degree

**Course name:** Special theme on food safety and science

**Course code:** \_\_\_\_\_; **Credits:** 2; **Scheduled Teaching hours:** 32 (experiments: 0 hours)

**Course type:** PPT/cases study;

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

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

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

Food Science and Technology

### III 、 Prerequisite course:

Microbiology, Food Microbiology, Biochemistry, Food Hygiene, Food Toxicology, Foodsafetiology, Food Chemistry, Food Analysis, Food Technology et al

### IV 、 Teaching objective:

The aim of this course is to enable the students in this major understand and learn the main research progress

of food safety and scientific technology, especially the current major food safety problems in China. After studying this course, the students are expected to understand the research hotspots and development trends of pathogenic microorganisms, pesticides, veterinary drugs, fungal toxins, heavy metals and food additives in food safety, as well as learn the core technologies and methods in the field of food safety and quality control. Finally, the study of this course can provide the theoretical foundation and basic technical methods for scientific research, technological development and new products exploitation.

## **V、Teaching methods**

The main teaching methods of this course include pedagogy, task-driven method and self-study method.

Case 1: Summarizing the characteristics of foodborne pathogen

We use task-driven method when perform the course of "foodborne pathogen contamination of food". Firstly, at the end of the last class, the teacher leaves some questions to the students. For examples, What are the main foodborne pathogens? What are the biological properties of foodborne pathogens? What kinds of foods are easily contaminated by foodborne pathogens? What are the main mechanisms of poisoning? We divide all students into four classes to search the relevant informations. Each class select a specific pathogens as the research objective to finish this project. Then a representative from each group shall report on the review and summary of the above questions.

Case 2: Analyzing the disease of postharvest agricultural products during storage

At the end of the project of biological control technology for postharvest diseases of agricultural products, the teacher assigns tasks to each group of students. The tasks are listed as what are the main microorganisms that threaten the storage of agricultural products after harvest? What is the mechanism that causes productions corruption? What are the common biological control methods? Students are required to sort out the informations and hold symposium after class, and select representatives to report the literature review and summary in the next class.

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

Chapter one: Food contamination by foodborne pathogens and the corresponding control technologies (8 class hours).

1. Contamination of food by foodborne pathogens (4 class hours).
2. The safe control technologies for foodborne pathogens in food (4 class hours)

Chapter two: Contamination of food by mycotoxin and its control technology (10 class hours)

1. Contamination of food by fungi and fungal toxins (4 class hours)
2. Safe control technologies of fungi and fungal toxins in foods (6 class hours)



Chapter three: Food contamination by chemical substances and its control technology (14 class hours)

1. Strategies to solve the food contamination caused by pesticides and veterinary drugs (4 class hours).
2. Strategies to solve the contamination of food by hazardous metals (4 class hours).
3. Strategies to solve the food contamination caused by harmful chemicals (2 class hours).
4. Strategies to solve the food contamination caused by food additives (2 class hours).
5. Strategies to solve the food contamination caused by containers and packaging materials (2 class hours).

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

Some international journals listed below are recommended to assist students to learn this course.

Science、Nature、Cell、Proceedings of the National Academy of Sciences (PNAS)、Critical Reviews in Microbiology、Trends in Food Science & Technology、Journal of Agricultural and Food Chemistry、Food Chemistry、Food Control、International Journal of Food Microbiology、Food Microbiology、Journal of Functional Foods、Food & Function、Journal of Dairy Science、Biofouling、LWT-Food Science and Technology、Journal of Food Engineering、Food Packaging and Shelf Life et al

**VII、Lecture(s):**

Haiying Cui, Lin Lin, Ce Shi, Hongxun Tao, Jinlong Xu, Xiaochen Chen

**IX、Responsible for syllabus design:**

Haiying Cui, Hongying Zhang

## 课程简介:高级食品化学

课程名称: 高级食品化学

学分:2

教学学时:32

教学大纲内容:

高级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: Advanced Food Chemistry

Course Name: Advanced Food Chemistry

Credit: 2

Teaching hours: 32

Contents of the Syllabus:

Advanced 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: 高级食品化学

课程代码: ES083200D1817

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):

食品科学与工程硕士

### 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 York: 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: Advanced Food Chemistry

Course code: ES083200D1817

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 Master

### 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 York: Springer verlag, Berlin Heidelberg, 1999

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

**IX、Responsible for syllabus design:** Qu Wenjuan

## 课程简介：食品实验设计与数据处理

**课程名称：** 食品试验设计与数据处理

**授课对象：** 留学硕士和博士

**学 分：** 2

**学 时：** 32 学时

### 课程内容：

在食品生产和科学研究中，为了寻求优质、高效、低耗的方法等，经常要进行各种实验。如何合理安排实验，如何对结果进行科学分析，是食品生产、科研工作者经常遇到的现实问题。实验设计的任务就是以概率论与数理统计知识为理论基础，结合专业知识和实践经验，经济、科学、合理地安排实验；有效地控制实验干扰；力求用较少的人力和时间，最大限度地获得丰富而可靠的资料；充分利用和科学地分析所获取的实验信息，从而达到能明确回答研究项目所提出的问题和尽快获得最优方案的目的。本课程的内容包括实验设计案例分析，实验结果的比较和分析、方差分析、回归与相关分析、主成分分析、层次聚类分析，因子设计、响应面设计、田口设计等方面。通过本课程的学习使学生在进行科学研究之前，学会采用合理的实验设计方法对实验进行设计，学习如何对实验所获取的数据可靠性、有效性进行分析，并选择合适的统计分析方法对实验数据进行统计学分析和处理，最后得到科学的结论。

## **Introduction of the Course: The Experimental design and data Processing**

**Course Name:** The Experimental design and data Processing

**Credit:** 2

**Teaching hours:** 32

### **Contents of the Syllabus:**

In food production and scientific research, in order to seek high-quality, high-efficiency, low-consumption methods, etc., various experiments are often carried out. How to reasonably arrange experiments and how to scientifically analyze the results are practical problems that food production and scientific research workers often encounter. The task of experimental design is to use probability theory and mathematical statistics knowledge as the theoretical basis, combine professional knowledge and practical experience, arrange experiments economically, scientifically and reasonably; effectively control experimental interference; strive to use less manpower and time to obtain abundant and reliable data as much as possible; make full use of and scientifically analyze the obtained experimental information, so as to achieve the purpose of clearly answering the questions raised by the research project and obtaining the optimal solution as soon as possible. The content of this course includes case analysis of experimental design, comparison and analysis of experimental results, analysis of variance, regression and correlation analysis, principal component analysis, hierarchical cluster analysis, factorial experimental design, response surface methodology and Taguchi design, etc. Through the study of this course, students will learn to use reasonable experimental design to design experiments before conducting scientific research, learn how to analyze the reliability and validity of the data obtained from the experiments, and select appropriate statistical analysis

method to analyze and processing the experimental data, and finally get a scientific conclusion.

## 课程名称：食品试验设计与数据处理

课程代码：083200D1809

I、上课时间： 32 （实验： 0 hours） 学分： 2； 课程类型： 选修课；

学期： 秋 学期； 考核方式： 书面报告/口头报告/作业；

开课单位： 食品与生物工程学院

### II、适用学科及专业类别：

食品科学与工程、生命科学、化学、化工等相关专业

### III、先修课程：

高级数学、线性代数或概率与统计中的任何一门课

### IV、教学目标：

本课程的目标在于介绍统计学基本术语、实验设计的基本原理、不同的实验设计方法、数据处理方法。该课程重点在于强调如何根据研究目的选择合适的实验设计，如何使用软件设计实验，以及如何使用软件分析实验数据并得出有意义的结论。本课程涵盖的主题适用于需要进行实验设计和数据收集、分析和解释的硕士和博士生。学完本课程后，学生应能够：

- 进行科学假设检验
- 了解描述性统计分析和推断性统计分析的区别
- 了解实验设计的问题和原则
- 进行适当的实验设计，例如因子设计、响应面方法、田口设计
- 选择合适的统计模型分析实验数据
- 解释和呈现统计结果并得出有意义的结论

### 五、教学方法

- 口头讲座
- 案例研究（课堂讨论）
- PPT 报告

### VI、课程内容和课时分配：

#### 第1章简介 （2小时）

1. 实验设计目的
2. 实验设计简史

3. 统计学和实验设计的基本原理
4. 设计和实施实验以及分析实验数据的指南

## 第 2 章 简单比较设计（ 2 小时）

1. 基本统计概念
2. 样本分布
3. 描述性统计
4. 比较两组实验数据（t 检验）
5. 样本量和统计检验力

## 第 3 章 方差分析（ 6 小时）

1. ANOVA 的假设
2. 识别异常值
3. 正态性、标准差和方差检验
4. 非常数方差变换
5. 方差分析的特征
6. 单因素方差分析
7. 模型适用性评估
8. 多重比较

## 第 4 章 回归与相关性分析（ 2 小时）

1. 回归和相关性
2. 线性回归
3. 多元线性回归
4. 显著性检验
5. 失拟检验
6.  $r^2$  和  $r$  的计算

## 第 5 章 实验设计——因子设计（ 6 小时）

1. 因子实验介绍
2. 两因素因子设计
3. 全因子设计
4. 因子设计中的区组
5.  $2^k$  因子设计
6. 筛选实验设计



- (1)  $2^{k-p}$  部分因子设计
- (2) Plackett -Burman 设计
- (3) 明确筛选设计

#### **第 6 章 实验设计 – 拉丁方、嵌套和裂区设计（2 小时）**

1. 拉丁方格设计
2. 嵌套设计
3. 裂区设计

#### **第 7 章 实验设计 - 响应面设计和混合设计（4 小时）**

1. 响应面法简介
2. 最陡上升法
3. 二阶 RSM 的分析
4. 中心复合设计
5. Box-Behnken 设计
6. 混合设计

#### **第 8 章 实验设计 – 田口设计（2 小时）**

1. 稳健参数设计方法的总体思路
2. 交叉阵列设计
3. 组合阵列设计
4. 静态和动态田口设计

#### **第 9 章 主成分分析和层次聚类分析（2 小时）**

1. PCA 和 HCA 的应用
2. 构造协方差矩阵
3. 计算特征值和特征向量
4. 使用 MINITAB 进行 PCA 分析
5. 使用 MINITAB 进行 HCA 分析

#### **第 10 章 案例分析和 PPT 报告（4 小时）**

1. 案例分析
2. PPT 报告

#### **VII 、教材、主要参考书及其他学生参考资料：**

**教材：**讲座 PPT、文章、教材、网站、Minitab 用户手册

**参考书籍：** Design and analysis of experiments by Douglas C. Montgomery

其他参考资料： Minitab 软件和 Excel

**VII、授课教师：**

陈秀敏

**IX、制定课程大纲教师：**

陈秀敏

**Course name: The Experimental design and data Processing**

**Course code: 083200D1809**

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

**Opening semester : Autumn semester ; Assessment method : activity report/Oral presentation/Assignments ;**

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

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

Food science and engineering and other related majors in life science, chemistry, and chemical engineering

**III 、 Prerequisite course:**

Any one of Advanced Mathematics, Linear Algebra, or Probability and Statistics

**IV 、 Teaching objective:**

The objectives of this course are to introduce the terminology, underlying statistical principles of experimental design, different design of experiments, the data processing methods. We will particularly emphasize on how to choose appropriate experimental designs based on research objectives, how to use software to design the experiment, and how to analyze the experimental data using software. The topics covered should be useful to students at the Masters and Ph.D. level who might be involved in the design of experiments or the collection, analysis and interpretation of data from designed experiments. Upon completion of this course, students are expected to be able to:

- Formulate hypothesis testing
- Know the difference of descriptive and inferential statistical analysis
- Understand the issues and principles of Design of Experiments
- Conduct appropriate experiment designs e.g. factorial design, response surface methodology, Taguchi design

- Selecting appropriate statistical models to analyze the experimental data
- Interpretate and present statistical results and draw meaningful conclusion

## **V、Teaching methods**

- Oral lecture
- Case study (in class discussion)
- PPT presentation

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

### **Chapter 1 Introduction (2 hours)**

1. The purpose of design of experiment
2. An abbreviated history of design of experiment
3. Basic principles of statistics and experimental design
4. Guidelines for planning, conducting and analyzing experiments

### **Chapter 2 Simple comparative design (2 hours)**

1. Basic statistical concepts
2. Sampling distribution
3. Descriptive statistics
4. Comparison of two treatments (t-test)
5. Sample size and power

### **Chapter 3 Analysis of variance (6 hours)**

1. Hypothesis and assumption of ANOVA
2. Identify outlier
3. Normality, StDev and variance check
4. Nonconstant variance transformation
5. Characteristics of ANOVA
6. One way ANOVA
7. Evaluation of Model fitness
8. Multiple comparisons

### **Chapter 4 Regression and correlation (2 hours)**

1. Regression and correlation
2. Linear regression
3. Multiple linear regression

4. Significant test of regression
5. Test of lack of fit
6. Calculation of  $r^2$  and  $r$

#### **Chapter 5 Design of Experiment – Factorial design ( 6 hours)**

1. Introduction of factorial experiments
2. Two-factor factorial design
3. General factorial design
4. Blocking in a factorial design
5.  $2^k$  factorial design
6. Screening designs
  - (1)  $2^{k-p}$  fractional factorial design
  - (2) Plackett-Burman Design
  - (3) Definitive screening design

#### **Chapter 6 Design of Experiment – Latin square, Nested and Split-plot designs (2 hours)**

1. Latin square design
2. Nested design
3. Split-plot design

#### **Chapter 7 Design of Experiment – Response surface methodology and mixture design (4 hours)**

1. Introduction to Response Surface Methodology
2. The method of steepest ascent
3. Analysis of a second-order RSM
4. Central composite design
5. Box-Behnken design
6. Mixture design

#### **Chapter 8 Design of Experiment – Taguchi design (2 hours)**

1. The general idea of Robust Parameter Design approaches
2. Crossed array design
3. Combined array design
4. Static and dynamic Taguchi design

#### **Chapter 9 Principal component analysis and hierarchical cluster analysis (2 hours)**

1. Application of PCA and HCA

2. Construct covariance matrix
3. Calculate eigenvalues & eigenvectors
4. Use MINITAB perform PCA
5. Use MINITAB perform HCA

**Chapter 10 Case study and PPT presentation (4 hours)**

1. Case study
2. PPT presentation

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

**Teaching material:** Lecture PPT, articles, books, websites, Minitab manual

**Reference books:** Design and analysis of experiments by Douglas C. Montgomery

**Other reference materials:** Minitab software and Excel

**VII、Lecture(s):**

CHEN XIUMIN

**IX、Responsible for syllabus design:**

CHEN XIUMIN

**课程名称：**谷物科学与技术原理

**课程代码：**ES083200D1821

**授课对象：**食品科学、生物与医药（食品工程）研究生

**学 分：**2

**学 时：**32

**课程内容：**

谷物科学与技术原理是食品科学、生物与医药（食品工程）专业研究生的选修课程，也是粮食、油脂和植物蛋白工程二级学科的基础课程。课程以谷物结构与组分的物理、化学和生物特性等基础科学，以及谷物加工利用的技术原理为主要讲授内容。课程内容主要包括：“谷物科技的发展史和前沿方向”、“谷物加工的科学原理”、“谷物加工的技术原理”和“面条科学与加工技术原理”4部分。课程要求学生了解谷物科技的发展史和前沿方向，掌握谷物结构与组分的物理、化学、生物学基本特性和谷物加工的技术装备原理；同时，引导学生进行批判性思考，分析解决谷物加工和产品开发中涉及的理论和技术瓶颈问题，并充分理解谷物加工的理论和技术创新等对国民经济、国家粮食安全及国民健康的重要意义。

## **Introduction of the Course: Principles of Cereals Science and Technology**

**Course Name: Principles of Cereals Science and Technology**

**Credit: 2**

**Teaching hours: 32**

**Contents of the Syllabus:**

Principles of Cereal Science and Technology is an elective course for postgraduate students majoring in food science and biology and medicine (food engineering), and also a basic course for the secondary discipline of cereal, oil, and plant protein engineering. This course focuses on basic principles of physical, chemical, and biological properties of the chemical components in cereal kernel and its products, as well as the principles related to cereal processing and their utilization in foods. The contents of this course mainly include four parts below, (1) The history and frontier of cereal science and technology; (2) The principles of cereal science; (3) The principles of cereal processing; (4) The principles of Asian noodle processing. After taking this course, the students should be familiar with the history and frontiers of cereal science and technology, and master the basic physicochemical and functional properties of cereal components, including starch, protein, lipids, and other minor components. In addition, the

principles related to cereal food processing and the related equipment are also should be known well. Moreover, the students should have the ability to critically thinking, and abilities to analyze and solve problems in theory and technology during cereal processing. Last but not the least, the students taking this course should fully understand the significance of innovations in theory and practice in cereal science to the economy, food security, and human health.

## 课程名称：谷物科学与技术原理

课程代码：ES083200D1821

### 一、课程简介：

课时:32 学时(实验 0 学时); 学分:2 学分; 课程类型:选修课;

开学学期: 春季学期; 考核方式:笔试/报告/随堂测验/;

打开单位: 食品与生物工程学院

### 二、适用学科和专业学位类别：

食品科学，食品工程，生物与医药，留学学硕

### 三、必修课程：

食品化学；食品工程

### 四、教学目的

通过学习本课程，使学生了解谷物科技的发展史和前沿趋势，掌握谷物加工涉及的核心科学和技术原理，了解国内外谷物领域的新产品、新技术和新装备；同时，培养学生在科研中养成批判性思维，善于提出、分析和解决科学研究及实际生产中存在理论或实际问题，并充分理解谷物的品种创新、高效种植、安全储运、科学加工和利用等对国民经济、国家粮食安全和国民健康的重要意义。

### 五、教学方式

课堂讲授、分组研讨。

### 六、课程内容、学时分配（共 32 学时）

#### 第一讲 谷物科学与技术的前沿（2 学时）

1.1 课程简介和谷物科技史；

1.2 谷物科技的前沿方向。

#### 第二讲 谷物加工的科学原理（16 学时）

2.1 谷物籽粒的结构特性（2 学时）

1) 禾本科谷物的籽粒结构特性；

2) 常见假谷物的籽粒结构特性。

## 2.2 谷物淀粉的结构、性质与功能（8 学时，含实验 2 学时）

1) 淀粉来源、合成和分离提取；

2) 淀粉的组成、性质和结构；

3) 淀粉的相变和功能特性与；

4) 淀粉的物化改性和食品应用；

5) **实验：**淀粉的形态和显微鉴别（1 学时）；淀粉的掺假分析测定（1 学时）。

## 2.3 谷物蛋白与脂质的结构与功能（4 学时）

1) 谷物蛋白的组成、结构、性质与功能；

2) 谷物脂质的组成、结构、性质与功能。

## 2.4 谷物中少量组分的结构与功能（2 学时）

1) 谷物非淀粉多糖；

2) 谷物酶、矿物质、维生素等少量组分。

# 第三讲 谷物加工的技术原理（8 学时）

## 3.1 谷物干燥和贮藏的基本原理（2 学时）；

1) 谷物干燥原理；

2) 谷物虫害和贮藏原理。

## 3.2 谷物粉碎原理与技术（4 学时）；

1) 小麦制粉；

2) 谷物组分的粉碎技术；

## 3.3 谷物副产物加工技术（2 学时）。

1) 谷物副产物的热加工；

2) 谷物副产物的非热加工。

# 第四讲 面条加工科学与技术原理（6 学时）

## 4.1 面条加工原料学（4 学时）

1) 面筋特性与面条品质；

2) 淀粉特性与面条品质；

3) 少量组分与面条品质。

## 4.2 面条加工工艺及品质评价技术（2 学时）

# 七、参考书目及学习资料

1. Jan A. Delcour and R. Carl Hoseney. *Principles of Cereal Science and Technology*, 3<sup>rd</sup> (Eds.), 2010. AACC.
2. Rosentrater, K. A., and Evers, A. D. *Kent's Technology of Cereals*. 5<sup>th</sup> (Eds.). 2017. Woodhead Publishing.
3. BeMiller, J. N. *Carbohydrate Chemistry for Food Scientists*. 2<sup>nd</sup> (Eds.), 2018. San Diego: Elsevier.
4. Whistler, R.L., J.N. Bemiller, and E.F. Paschall. *Starch Chemistry and Technology*. 3<sup>rd</sup> (Eds.), 2009. Taylor.
5. Lásztity, R. r. *The Chemistry of Cereal Proteins*, 2<sup>nd</sup> (Eds.), 1996. Boca Raton: CRC Press.
6. Fereidoon Shahidi. *Bailey's Industrial Oils and Fat Products*, 6<sup>th</sup> (Eds.), 2006. Wiley-Blackwell.



7. Damodaran, S., & Parkin, K. L. *Fennema's Food Chemistry*, 5<sup>th</sup> (Eds.), 2017. Boca Raton: CRC Press.
8. Posner, E. S., and Hibbs, A. N. *Wheat Flour Milling*. 2<sup>nd</sup> (Eds.), 2005. AACC.
9. Kaletunç, G. n. I., & Breslauer, K. *Characterization of Cereals and Flours: Properties, Analysis, and Applications*. 2003, New York: Marcel Dekker.
10. Kruger, J. E., Matsuo, R. B., and Dick, J. W. *Pasta and Noodle Technology*. 1996. AACC.
11. Hou, G. G. et al. 2020. *Asian Noodle Manufacturing: Ingredients, Technology, and Quality*. Elsevier.

八、课程讲授者：陈中伟

九、大纲撰写人：陈中伟

**Course name: Principles of cereal science and technology**

**Course code: ES083200D1821**

**I 、Scheduled Teaching hours:** 32 (experiments: 0 hours) **Credits:** 2; **Course type:** Elective course;

**Opening semester:** Spring semester; **Assessment method:** Written examination /activity report/quiz/;

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

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

Food Science, Food Engineering, and Biology & Medicine, Academic master

**III、Prerequisite course:**

Food chemistry and Food engineering

**IV、Teaching objective:**

By studying this course, the students should be familiar with the history and frontier of cereal science and technology, master the essential principles of cereal science and technology, and understand the new technologies and equipment in the field of cereal processing. In addition, the students should have the abilities of critical thinking, and are good at proposing, analyzing, and solving problems in cereal processing and utilization. lastly, the students should fully understand the significance of cereal farming, storage and transportation, processing and utilization for the national economy, food security, and human health.

**V 、Teaching methods**

Classroom teaching and group discussion

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

**Lecture 1 Frontiers in cereal science and technology (2 hours)**

1.1 Course introduction & the history of cereal technology;

1.2 Frontier of cereal science and technology.

**Lecture 2 Principles of cereal science (16 hours)**

2.1 Structural characteristics of cereal grains (2 hours)

## 2.2 Structure, properties, and functions of cereal Starch (8 hours)

- 1) Starch source, synthesis, isolation, and extraction;
- 2) Composition, properties, and structure of starch;
- 3) Phase transition and functional properties of starch;
- 4) physicochemical modification of starch and food application;

## 2.3 Structure and function of cereal proteins and lipids (4 hours)

- 1) Composition, structure, properties, and functions of cereal protein;
- 2) Composition, structure, properties, and functions of cereal lipids.

## 2.4 Structure and function of minor components in cereals (2 hours)

- 1) Cereal non-starch polysaccharide;
- 2) Cereal enzymes, minerals, vitamins, and other small fractions.

### **Lecture 3 Technical principles of cereal processing (8 hours)**

#### 3.1 Basic principles of grain drying and storage (2 hours);

- 1) Cereal drying;
- 2) Cereal storage principles.

#### 3.2 Grain crushing principle and technology (4 hours);

- 1) Wheat flour milling;
- 2) Grinding technology of cereal products;

#### 3.3 Grain by-product processing technology (2 hours).

- 1) Thermal processing of cereal by-products;
- 2) Non-thermal processing of cereal by-products.

### **Lecture 4 Principles of science and technology in asian noodle processing (6 hours)**

#### 4.1 Noodle processing materials (4 hours)

- 1) Relationship between gluten and noodle quality;
- 2) Starch properties and noodle quality;
- 3) Small amount of ingredients and noodle quality.

#### 4.2 Noodle processing technology and quality evaluation technology (2 hours).

## **VII、Teaching material, main Reference books, and other reference materials for students:**

**Teaching material:** PPT, No specific textbook.

### **Reference books:**

- Jan A. Delcour and R. Carl Hoseney. Principles of Cereal Science and Technology, 3rd (Eds.), 2010. AACC.
- Rosentrater, K. A., and Evers, A. D. Kent's Technology of Cereals. 5th (Eds.). 2017. Woodhead Publishing.
- BeMiller, J. N. Carbohydrate Chemistry for Food Scientists. 2nd (Eds.), 2018. San Diego: Elsevier.
- Whistler, R.L., J.N. Bemiller, and E.F. Paschall. Starch Chemistry and Technology. 3rd (Eds.), 2009. Taylor.
- Lásztity, R. r. The Chemistry of Cereal Proteins, 2nd (Eds.), 1996. Boca Raton: CRC Press.
- Fereidoon Shahidi. Bailey's Industrial Oils and Fat Products, 6th (Eds.), 2006. Wiley-Blackwell.
- Damodaran, S., & Parkin, K. L. Fennema's Food Chemistry, 5th (Eds.), 2017. Boca Raton: CRC Press.
- Posner, E. S., and Hibbs, A. N. Wheat Flour Milling. 2nd (Eds.), 2005. AACC.
- Kaletunç, G. n. l., & Breslauer, K. Characterization of Cereals and Flours: Properties, Analysis, and

Applications. 2003, New York: Marcel Dekker.

- Kruger, J. E., Matsuo, R. B., and Dick, J. W. Pasta and Noodle Technology. 1996. AACC.
- Hou, G. G. et al. 2020. Asian Noodle Manufacturing: Ingredients, Technology, and Quality. Elsevier.

**Other reference materials:** None.

**VIII、Lecture(s):** Zhongwei Chen

**IX、Responsible for syllabus design:** Zhongwei Chen

# 课程名称：食品生物分离与提取技术

学分：2 学分

学时：32 学时

## 大纲内容：

随着食品工业的发展，单元操作不断向食品工业渗透并在食品加工领域内实践和提高，形成了适应食品加工特殊要求的新的单元操作。由于食品加工所用的动植物性原料几乎都为固态和液态，为了使固体和液体原料成为多种美味可口、营养丰富的食品，首先必须提取其精华，扬弃其糟粕，分离出不同成分并组合成不同种类的制品。同时为了做到有益无毒，风味别致，又必须反复提纯和精制。因此分离操作已在食品工业中占有相当重要的地位，研究分离技术在食品加工中的应用，对食品加工的科学化具有重要意义。

通过本课程的学习，使学生了解生物分离技术的研究对象、目的及在工农业、医药卫生业及生物工程领域上的意义；了解本学科的研究现状及发展前景；重点掌握食品下游加工中常见的细胞破碎技术、萃取分离技术、沉析分离技术、过滤与膜分离、静态吸附与离子交换分离技术、固相析出分离、层析分离、浓缩、结晶与干燥技术的原理及应用，熟悉各种食品产品的提取分离技术。

## 第一章 提取（4 学时）

1. 基本原则
2. 液液萃取
3. 双水相萃取
4. 超临界萃取
5. 微波，超声波和酶辅助提取
6. 应用程序

## 第二章 膜分离（4 学时）

1. 膜的配置
2. 膜的模块
3. 传输机制
4. 微滤，超滤和纳滤
5. 膜的污染
6. 在食品工业中的应用

### 第三章 干燥（2 学时）

1. 干燥的原因/脱水
2. 干燥的机理
3. 干燥效率
4. 干燥的基本方法和设备
5. 升华干燥

### 第四章 离心（2 学时）

1. 操作原理
2. 离心设备的构成
3. 超高速离心
4. 安全与预防性维护
5. 应用案例

### 第五章 浓缩分离（2 学时）

1. 降水原理
2. 影响因素
3. 重力集中指定
4. 增稠剂的介绍

### 第六章 反相色谱（4 学时）

1. 基本原则
2. 反相色谱的基质
3. 亲和层析分离设计
4. 疏水作用色谱法
5. 应用实例

### 第五章 亲和力和离子交换色谱（4 小时）

1. 概述
2. 亲和层析的组成
3. 亲和层析用配体
4. 亲和层析吸附剂
5. 离子交换色谱基质
6. 离子交换色谱分离设计
7. 应用程序

## 第八章 蛋白质分离纯化（4 小时）

1. 概述
2. 天然聚丙烯酰胺凝胶电泳
3. 十二烷基硫酸钠-聚丙烯酰胺凝胶电泳
4. 等电聚焦
5. 二维电泳
6. Western blot 方法
7. 毛细管电泳

## 第九章 生物分离技术分析（6 学时）

1. 生物分离技术实例分析
2. 生物分离技术在食品工业中的综合应用

# **Introduction of the Course: Bio-separations and Extraction Technique in Food Industry**

**Course Name:** Bio-separations and Extraction Technique in Food Industry

**Credit:** 2

**Teaching hours:** 32

### **Contents of the Syllabus:**

With the development of food industry, unit operation has penetrated into the food industry and been practiced and improved in the field of food processing, forming a new unit operation to meet the special requirements of food processing. Since almost all animal and plant raw materials used in food processing are solid and liquid, in order to make solid and liquid raw materials into a variety of delicious and nutrient-rich food, first of all, must extract its essence, discard its dross, separate different components and combine into different kinds of products. At the same time, in order to achieve beneficial non-toxic, unique flavor, and must be repeatedly purified and refined. Therefore, separation operation has played a very important role in the food industry. The research on the application of separation technology in food processing is of great significance to the scientific food processing.

Through the study of this course, students can understand the research object, purpose and significance of bioseparation technology in the field of industry and agriculture, medicine and health industry and bioengineering. Understand the research status and development prospect of the subject; Key to master common cell crushing

technology in food processing, extraction separation, settling out separation, filtration and membrane separation, static adsorption and ion exchange separation, solid phase crystallization precipitation separation, chromatographic separation, enrichment, and the principle and application of drying technology, familiar with all kinds of the extraction and separation technology of food products.

## **Chapter 1 Extraction**

**4 hours**

1. Basic principles
2. Liquid-liquid extraction
3. Aqueous two-phase extraction
4. Supercritical extraction
5. Microwave-, ultrasound-, and enzyme-assisted extractions
6. Applications

## **Chapter 2 Membrane Separation**

**4 hours**

1. Configuration
2. Modules
3. Transport mechanism
4. Microfiltration, Ultrafiltration and Nanofiltration
5. Fouling
6. Application in food industry

## **Chapter 3 Dehydration**

**2 hours**

1. Reasons for drying/dehydration
2. Mechanism of drying
3. Drying efficiency
4. Basic methods and equipment for drying
5. Lyophilisation

## **Chapter 4 Centrifugation**

**2 hours**

1. Principle of Operation
2. Diagrams
3. Ultra-centrifugation
4. Safety & Preventive Maintenance
5. Applications

## **Chapter 5 Concentration Separation**

**2 hours**

1. Principle of precipitation
2. Influence Factors
3. Gravity Concentration designation
4. Thickeners Introduction

## **Chapter 6 Reversed-phase chromatography**

**4 hours**

1. Basic principles
2. Matrix for reversed-phase chromatography
3. Design for affinity chromatographic separation
4. Hydrophobic interaction chromatography
5. Applications

## **Chapter 7 Affinity and Ion-exchange Chromatography**

**4 hours**

1. Overview
2. The components of affinity chromatography
3. Ligand used in affinity chromatography
4. Affinity chromatography adsorbents
5. Matrix for ion-exchange chromatography
6. Design for ion-exchange chromatographic separation
7. Applications

## **Chapter 8 Protein Separation & Purification**

**4 hours**

1. Overview
2. Native polyacrylamide gel electrophoresis
3. Sodium dodecyl sulfate- polyacrylamide gel electrophoresis
4. Iso-electric focusing
5. Two-dimensional electrophoresis
6. Western blotting
7. Capillary electrophoresis

## **Chapter 9 Analysis of practices in Bio-separation Techniques**

**6 hours**

1. Bio-separation Techniques experiments
2. Enterprises touring for bio-separation techniques



# 课程名称:食品生物分离与提取技术

课程代码: ES083200D1807

I, 课时:32 学时(实验 0 学时): 2 学分; 课程类型:选修课;

开学学期:春季学期; 考核方式: 报告;

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:

食品科学与技术, 硕士学位。

III, 必修课程:

食品化学, 生物化学, 食品检测与分析

IV, 教学目标:

食品原料是由多种配料混合而成的, 生产产品时根据人们对原料的需要进行选择的这样一种过程就是食品分离技术。分离的目的是除去特定的成分, 以获得更高纯度的成分, 增加产品价值。然后购买符合食品安全要求的产品。食品分离技术是食品工业的基础, 绝大多数食品工业都没有分离食品分离技术, 其中很多都是以分离工程为基础的工业主要生产工艺。如植物油的提取、淀粉的分离、糖类产品的分离和精炼提纯。通过食品分离技术可以提高食品原料的利用水平, 保持和改善食品的营养和风味。

V, 教学方法

课堂教学

VI, 课程内容、学时分布及学生要求:

第一章 提取(4 学时)

1. 基本原则
2. 液液萃取
3. 双水相萃取
4. 超临界萃取
5. 微波, 超声波和酶辅助提取
6. 应用程序

第二章 膜分离(4 学时)

1. 膜的配置
2. 膜的模块

3. 传输机制
4. 微滤，超滤和纳滤
5. 膜的污染
6. 在食品工业中的应用

### 第三章 干燥（2 学时）

1. 干燥的原因/脱水
2. 干燥的机理
3. 干燥效率
4. 干燥的基本方法和设备
5. 升华干燥

### 第四章 离心（2 学时）

1. 操作原理
2. 离心设备的构成
3. 超高速离心
4. 安全与预防性维护
5. 应用案例

### 第五章 浓缩分离（2 学时）

1. 降水原理
2. 影响因素
3. 重力集中指定
4. 增稠剂的介绍

### 第六章 反相色谱（4 学时）

1. 基本原则
2. 反相色谱的基质
3. 亲和层析分离设计
4. 疏水作用色谱法
5. 应用实例

### 第五章 亲和力和离子交换色谱（4 小时）

1. 概述
2. 亲和层析的组成
3. 亲和层析用配体

4. 亲和层析吸附剂
5. 离子交换色谱基质
6. 离子交换色谱分离设计
7. 应用程序

#### 第八章 蛋白质分离纯化（4 小时）

1. 概述
2. 天然聚丙烯酰胺凝胶电泳
3. 十二烷基硫酸钠-聚丙烯酰胺凝胶电泳
4. 等电聚焦
5. 二维电泳
6. Western blot 方法
7. 毛细管电泳

#### 第九章 生物分离技术分析（6 学时）

1. 生物分离技术实例分析
2. 生物分离技术在食品工业中的综合应用

#### VII, 教材、主要参考书及其他学生参考资料:

教学材料: 课件、Web of Science 数据库。

参考书目:生物分离科学与工程(第二版), Roger G. Harrison, Paul W. Todd, Scott R. Rudge, Demetri P. Petrides, 牛津大学出版社。

其他参考材料:《食品中的生物分离过程》 作者:辛格, 美国 CRC 出版社。

VII, 授课教师: 张迪

IX, 教学大纲撰写人: 张迪

**Course name: Bio-separations and Extraction Technique in Food Industry**

**Course code: ES083200D1807**

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

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

**Opening unit: SFBE**

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

Food Science and Technology, Master degree.

## **III 、 Prerequisite course:**

Food Chemistry, Biochemistry, Food Testing and Analysis

## **IV 、 Teaching objective:**

Food raw materials are composed of a mixture of ingredients, the production of the product according to the needs of people for choice of raw materials for such a process is the food separation technique. The purpose of separating is to remove the particular component, in order to obtain a component of a higher purity and increase product value. Then get the products needed to meet the food safety requirements. Food separation technique is the basis for the food industry, the vast majority of the food industry are not separate food separation technology, many of which are based on separation engineering industry as the main production processes. Such as vegetable oils extraction, separation of starch, the sugar products separation and refining purification. Through food separation technology can improve the utilization level of food raw materials to maintain and improve the nutrition of food and flavor.

## **V 、 Teaching methods**

### **Class teaching**

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

### **Chapter 1 Extraction**

**4 hours**

7. Basic principles
8. Liquid-liquid extraction
9. Aqueous two-phase extraction
10. Supercritical extraction
11. Microwave-, ultrasound-, and enzyme-assisted extractions
12. Applications

### **Chapter 2 Membrane Separation**

**4 hours**

1. Configuration
2. Modules
3. Transport mechanism
4. Microfiltration, Ultrafiltration and Nanofiltration
5. Fouling
6. Application in food industry

### **Chapter 3 Dehydration**

**2 hours**

6. Reasons for drying/dehydration
7. Mechanism of drying
8. Drying efficiency
9. Basic methods and equipment for drying
10. Lyophilisation

#### **Chapter 4 Centrifugation**

**2 hours**

6. Principle of Operation
7. Diagrams
8. Ultra-centrifugation
9. Safety & Preventive Maintenance
10. Applications

#### **Chapter 5 Concentration Separation**

**2 hours**

1. Principle of precipitation
2. Influence Factors
3. Gravity Concentration designation
4. Thickeners Introduction

#### **Chapter 6 Reversed-phase chromatography**

**4 hours**

6. Basic principles
7. Matrix for reversed-phase chromatography
8. Design for affinity chromatographic separation
9. Hydrophobic interaction chromatography
10. Applications

#### **Chapter 7 Affinity and Ion-exchange Chromatography**

**4 hours**

5. Overview
6. The components of affinity chromatography
7. Ligand used in affinity chromatography
8. Affinity chromatography adsorbents
5. Matrix for ion-exchange chromatography
6. Design for ion-exchange chromatographic separation
7. Applications

#### **Chapter 8 Protein Separation & Purification**

**4 hours**

8. Overview
9. Native polyacrylamide gel electrophoresis
10. Sodium dodecyl sulfate- polyacrylamide gel electrophoresis
11. Iso-electric focusing
12. Two-dimensional electrophoresis
13. Western blotting
14. Capillary electrophoresis

**Chapter 9 Analysis of practices in Bio-separation Techniques**

**6 hours**

1. Bio-separation Techniques experiments
2. Enterprises touring for bio-separation techniques

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

**Teaching material:**

**Reference books:** Bioseparations Science and Engineering (2nd Edition), Roger G. Harrison, Paul W. Todd, Scott R. Rudge, Demetri P. Petrides, Oxford University Press, USA.

**Other reference materials:** Bioseparation Processes in Food. 作者: Singh, CRC Press, USA.

**VIII、Lecture(s):** Di Zhang

**IX、Responsible for syllabus design:** Di Zhang