课程详述

COURSE SPECIFICATION

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

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

1.	**课程名称 Course Title**	**微生物实验 Microbiology Laboratory**
2.	**授课院系 Originating Department**	生物系 Biology Department
3.	**课程编号 Course Code**	BI0205
4.	**课程学分 Credit Value**	2
5.	**课程类别 Course Type**	专业选修课（生物科学、生物技术、生物信息学专业） Major Elective Courses（Biological Sciences, Biotechnology, Bioinformatics Majors）
6.	**授课学期 Semester**	秋季 Fall
7.	**授课语言 Teaching Language**	中英双语 English & Chinese
8.	**授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） Instructor(s), Affiliation& Contact （For team teaching, please list all instructors）**	吕沫，生物系，lv.m3@sustc.edu.cn LVMo, Biology Department, lv.m3@sustc.edu.cn
9.	**实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact**	张敏，生物系，zhangm6@sustc.edu.cn Zhang Min, Biology Department, zhangm6@sustc.edu.cn
10.	**选课人数限额(可不填) Maximum Enrolment （Optional）**	

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

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	要求先修 BIO104 普通生物学实验；学习本实验课的同时学习 BIO 203 微生物学或者 ESE301 环境微生物学。 Pre-study General Biology Laboratory, and study the theory courses Microbiology or Environmental Microbiology with the experiments course in the same time.
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	
14. 其它要求修读本课程的学系 Cross-listing Dept.	环境科学工程 Environmental Science Engineering

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

微生物学是一门实践和应用性很强的学科，而微生物学实验是微生物学课程中重要的教学环节。本课程以动手实验为主，讲授为辅，通过实验课教学巩固和补充课堂上讲授的理论知识，使学生掌握基本的实验操作技术和科学实验的概念，比如学习显微镜的使用，无菌操作技术和纯培养等。微生物实验课是非常有价值的课程，它会让学生近距离的学习和研究微生物。而且，给学生提供机会去学习特殊的实验技巧，鉴别微生物的物种。并且学生可以掌握对观察实验现象，统计实验数据和分析实验数据的能力。并将所学的微生物理论知识有机的结合起来，为微生物的实际应用打下坚实基础。

Microbiology is a highly practical and applied disciplines, and microbiology laboratory is an important teaching curriculum. This course gives you a chance to learn the special techniques and is supplemented with lectures. It will help students to understand and add some knowledge of the theory course. The goal is to teach students basic techniques and concepts: the use of the microscope and the aseptic and pure culture techniques. A microbiology laboratory is valuable because it actually gives you a chance to see and study microorganisms firsthand. In addition, it provides you with the opportunity to learn the special techniques used to study and identify these organisms. The ability to make observations, record data, and analyze results is useful throughout life. These exercises are also designed to help students understand basic biological concepts that are the foundation for applications in all life science fields.

16. 预达学习成果 Learning Outcomes

该实验课让学生掌握微生物学中常用新的实验技能，受到观察某些微生物学现象的训练，同时培养学生从事科学研究工作的良好作风和工作习惯，逐步培养学生将学到的微生物规律和知识应用到各个领域。微生物实验课为学生打开了微生物的大门，希望学生能够掌握这门知识，并启发学生对这个领域的探索热情

The laboratory is chosen to give students an opportunity to learn new techniques and to expose them to a variety of experiences and observations. At the same time, it can train the students a good style and work habits in scientific research work. The principles and techniques demonstrated in microbiology laboratory can be applied to many fields. This course is an introduction to the microbial world, and we hope students will find it useful and interesting.

17. 课程内容及教学日历 （如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

第一章微生物学实验安全介绍和课程简介　　学时：4 学时

Lab 1 Introduction to microbiology Lab Safety and Lab course　　Hours: 4 h

主要内容：

Outline:

1.介绍微生物实验室规章制度，微生物实验操作安全。

Introduce the rules and regulations of microbiology laboratory and the safety of microbiology experiment operation.

2.介绍微生物实验课程内容和考核方式。

Introduce the contents and assessment methods of Microbiology laboratory course.

教学要求：

Requirements:

[掌握]

1.微生物实验课开始实验之前的注意事项

Notes before starting the experiment in Microbiology laboratory course

2.微生物实验室的安全配套设施的使用方法

How to use the safety supporting facilities in Microbiology laboratory

[熟悉]

1.安全事故的应急处理方法

Emergency handling methods for safety accidents

2.课程考核方式

Course assessment method

3.Lab report 和 Notebook 的书写要求

Written request of Lab report and Notebook

[了解]

1.课程内容

course content

重点、难点：微生物实验课的注意事项。Lab report 和 Notebook 的书写要求。

Key and difficulty: Notes before starting the experiment in Microbiology laboratory course. Written request of Lab report and Notebook

第二章微生物无菌操作技术和培养基的制备　　学时：5 学时

Lab 2 Aseptic Technique and Microbiological Culture Media Preparation　　Hours: 5 h

主要内容：

Outline:

1.微生物实验无菌操作技术简介。

Learn the common aseptic techniques.

2.培养基分类和功能。

Medium classification and function

3.学习培养基配制的方法和步骤。

Learn the method and procedure of medium preparation.

教学要求：

Requirements:

[掌握]

1.灭菌和消毒

Sterilization and disinfection

2.准备不同类型的培养基，培养基的高压灭菌方法。

Prepare different types of media, and Autoclave method of culture media.

[熟悉]

1.学习普通培养基、富集培养基、选择性培养基和筛选性培养基的功能。

Learn the function of general, enriched, selective, and differential media.

[了解]

1.培养基的基本组成元素和用途。

Basic elements and functions of the medium.

重点、难点：准备不同类型的培养基，培养基的高压灭菌方法。

Key and difficulty: Prepare different types of media, and Autoclave method of culture media.

第三章微生物的分离和纯化　　学时：5 学时

Lab 3 Isolation and purification of microorganisms　　Hours: 5 h

主要内容：

Outline:

1.微生物接种技术。

Subculture technology

2.微生物的分离和纯化技术。

Isolation and purification technology

教学要求：

Requirements:

[掌握]

1.微生物接种技术

Subculture

2.微生物的纯培养技术-平板划线方法

Pure culture-streak plate

3.微生物的纯培养技术-倒板方法

Pure culture-pour plate

4.微生物的纯培养技术-涂板方法

Pure culture-spread plate

[熟悉]

1. 微生物的培养温度和培养方法。

Culture temperature and method of microorganism

2. 微生物的形态描述。

Description of microbial morphology

[了解]

1.单克隆的概念。

The concept of the colony.

重点、难点：微生物的分离和纯化技术。

Key and difficulty: Isolation and purification technology.

第四章 环境中微生物的分离及纯化　　学时：5 学时

Lab 4 Isolating and purifying Microbes from Environment　　Hours: 5 h

主要内容：

Outline:

1.分离及纯化环境中的微生物。

Isolating and purifying Microbes from Environment

教学要求：

Requirements:

[掌握]

1.分离和检测不同水中的大肠杆菌

Monitor Escherichia coli in different kinds of water

2.肉中可引起食物中毒的细菌的检测

Detect food poisoning bacteria from fresh meat

[熟悉]

1. 环境中常见微生物含量的测定

Inspect the content of bacteria from environmental samples

[了解]

1.环境中的微生物。

Microbes in Environment

重点、难点：灵活应用分离纯化的方法，从不同环境中分离微生物。

Key and difficulty: The method of isolation and purification can be used flexibly to separate microorganisms from different environments..

第五章 微生物的染色及形态观察　　学时：5 学时

Lab 5 Morphology and Staining of Bacterial Specimens　　Hours: 5 h

主要内容：

Outline:

1.了解和掌握显微镜的使用方法。

Understand and master the operation of microscope

2.细菌染色的简单制片

Prepare heat-fixed smears

3.革兰氏染色、负染色、和抗酸染色的原理和操作步骤

The principle and technology of Gram stain, Capsule stain, and Acid-fast stain

4.观察鞭毛染色的示教片

Observe the demonstrations of flagella

教学要求：

Requirements:

[掌握]

1.光学显微镜的使用方法

The use of a light microscope

2.细菌染色的简单制片

Prepare heat-fixed smears

3.革兰氏染色的原理和操作步骤

The principle and technology of Gram stain

[熟悉]

1. 认识不同微生物的基本形态特征和特殊结构。

Recognize the basic morphological characteristics and special structures of different microorganisms

2.负染色的原理和操作步骤

The principle and technology of Capsule stain

3.抗酸染色的原理和操作步骤

The principle and technology of Acid-fast stain

[了解]

1.鞭毛染色的原理和方法

The principle and technology of flagella

重点、难点：油镜的使用，革兰氏染色、负染色、和抗酸染色的原理和操作步骤。

Key and difficulty: The principle and technology of Gram stain, Capsule stain, and Acid-fast stain

第六章 微生物的生化鉴定（上） 学时：5 学时

Lab 6 Techniques for Identifying Bacterial Species (a) Hours: 5 h

主要内容：

Outline:

1.掌握微生物鉴定原理及常用鉴定方法。

Master the principle and methods of microbial identification

教学要求：

Requirements:

[掌握]

1.三糖铁实验

Triple sugar iron test

2.石蕊牛乳实验

The litmus milk test

3.过氧化氢酶实验

Catalase test

4.氧化酶实验

Oxidase test

5.淀粉水解酶实验

Starch Hydrolysis

6.油脂水解实验

Lipid Hydrolysis

[熟悉]

1. 每个实验的现象和原理

The phenomena and principles of each experiment

2. 每个实验所用培养基的配制方法

Method of preparation of medium for each experiment

[了解]

1.每个实验的用途

The purpose of each experiment

重点、难点：每个实验的现象和原理。

Key and difficulty: The phenomena and principles of each experiment

第七章 微生物的生化鉴定（下） 学时：5 学时

Lab 7 Techniques for Identifying Bacterial Species (b) Hours: 5 h

主要内容：

Outline:

1.掌握微生物鉴定原理及常用鉴定方法。

Master the principle and methods of microbial identification

教学要求：

Requirements:

[掌握]

1.吲哚实验

Indole test

2.甲基红实验

Methyl red (MR) test

3.伏谱实验

Voges-Proskauer (VP) test

4.柠檬酸利用实验

Citrate utilization test

5.尿素水解酶实验

Urease test

6.苯丙氨酸脱氢酶实验

Phenylalanine Deamination

[熟悉]

1. 每个实验的现象和原理

The phenomena and principles of each experiment

2. 每个实验所用培养基的配制方法

Method of preparation of medium for each experiment

[了解]

1.每个实验的用途

The purpose of each experiment

重点、难点：每个实验的现象和原理。

Key and difficulty: The phenomena and principles of each experiment

第八章 微生物的生长和控制　　学时：6 学时

Lab 8　Bacteria Growth and Control　　Hours: 6 h

主要内容：

Outline:

1.了解细菌生长曲线特征。

To construct microbial growth curves.

2.观察物理、化学及生物因素对微生物生长的影响

To investigate some factors contributing to microbial growth.

3.了解杀菌及抑菌现象

To distinguish between a disinfectant and an antiseptic.

教学要求：

Requirements:

[掌握]

1.在不同营养条件下微生物的生长曲线特征

Bacterial growth curve on different nutrient conditions

2.紫外线对微生物生长的影响

Lethal effects of Ultraviolet Light

3.药敏试验对微生物生长的影响

Disk diffusion antibiotic sensitivity test

[熟悉]

1. 利用紫外分光光度计检测微生物的浊度

Measure the turbidity of microbe with ultraviolet spectrophotometer

2. 生长曲线的绘制方法

Growth curve drawing method

[了解]

1.不同的抗生素对不同微生物的抑制作用

The inhibitory effect of different antibiotics on different microbes

重点、难点：利用紫外分光光度计检测微生物的浊度，制作微生物的生长曲线。观察物理、化学及生物因素对微生物生长的影响。

Key and difficulty: Measure the turbidity of microbe with ultraviolet spectrophotometer to make the bacterial growth curve.To investigate some factors contributing to microbial growth.

第九章 噬菌体的效价测定　　学时：4 学时

Lab 9　Bacteriophage Plaque Assay for Phage Titer　　Hours: 4 h

主要内容：

Outline:

1.噬菌体的效价测定.

Determining bacteriophage titer.

教学要求：

Requirements:

[掌握]

1.噬菌体的效价测定

Determining Bacteriophage Titers

[熟悉]

1. 双层平板夹心技术

Double-Layer Agar (DLA) technique

[了解]

1.噬菌体的类型和生长繁殖方式。

Type and reproduction of phage.

2.T4 噬菌体的扩增方法

Proliferation of T4 Phage

重点、难点：双层平板夹心技术。

Key and difficulty: Double-Layer Agar (DLA) technique.

第十章 真核微生物和食品制作　　学时：4 学时

Lab 10　Eukaryotic Microbes and Food Production　　Hours: 4 h

主要内容：

Outline:

1.观察真核微生物的形态特点。

Observe the morphology and significance of the Eukaryotic Microbes

2.子囊孢子的染色

Ascospore Staining

3.学习利用微生物制作葡萄酒

Investigate the production of wine with microbe.

教学要求：

Requirements:

[掌握]

1.观察真核微生物的教学片

Observing the demonstrations of eukaryotic microbes

2.子囊孢子的染色

Ascospore Staining

[熟悉]

1. 酿酒

Make wine

[了解]

1.真核微生物的种类和形态特征。

Species and morphological characteristics of eukaryotic microbes

2.酵母的生长繁殖方式

Reproduces of yeast

重点、难点：真核微生物的形态特征。子囊孢子的染色。

Key and difficulty: Morphological characteristics of eukaryotic microbes. Ascospore Staining

第十一章免疫实验　　学时：4 学时

Lab 11　Immunoassay　　Hours: 4 h

主要内容：

Outline:

1.了解免疫测定的概念。

To understand the concepts in immunoassay

2.利用 ELISA 技术检测血清中的抗体。

Use an ELISA to detect the presence of antibodies in a serum sample.

教学要求：

Requirements:

[掌握]

1.利用 ELISA 技术检测血清中的抗体。

Use an ELISA to detect the presence of antibodies in a serum sample.

[熟悉]

1. 利用标准曲线计算未知样本的浓度

Calculate the unknown sample concentration using the standard curve

[了解]

1.免疫系统。

Immune system

2.ELISA 的几种常用方法

Some common methods pf Enzyme-linked immunosorbent assay (ELISA)

重点、难点：利用 ELISA 技术检测血清中的抗体。利用标准曲线计算未知样本的浓度。

Key and difficulty: Use an ELISA to detect the presence of antibodies in a serum sample.Calculate the unknown sample concentration using the standard curve

第十二章考试（上） 学时：4 学时

Lab 12 Final examination (a) Hours: 4 h

主要内容：

Outline:

1.分离鉴定未知微生物的种类

Isolation and identification of unknown microbial species

教学要求：

Requirements:

[掌握]

1.无菌操作技术。

Aseptic techniques.

2.革兰氏染色技术

Gram stain

3.培养基的制备

Prepare culture media

[熟悉]

1. 分析实验现象，总结实验结果。

Analyze the experimental phenomena and summarize the experimental results.

重点、难点：综合运用本学期所学的知识和技术分离鉴定未知微生物的种类。

Key and difficulty: Use the knowledge and techniques learned in this semester to isolate and identify unknown microbial species.

第十三章考试（下） 学时：4 学时

Lab 13 Final examination (b) Hours: 4 h

主要内容：

Outline:

1.分离鉴定未知微生物的种类

Isolation and identification of unknown bacterial species

教学要求：

Requirements:

[掌握]

1.利用生化鉴定的方法分离鉴定未知微生物。

Use the method of biochemical identification to isolate and identify unknown bacteria.

2.无菌操作技术

Aseptic techniques.

3.培养基的制备

Prepare culture media

[熟悉]

1. 分析实验现象，总结实验结果。

Analyze the experimental phenomena and summarize the experimental results.

重点、难点：综合运用本学期所学的知识和技术分离鉴定未知微生物的种类。

Key and difficulty: Use the knowledge and techniques learned in this semester to isolate and identify unknown bacterial species.

第十四章实验回顾与总结　　学时：4 学时

Lab 14　Lab review　　Hours: 4 h

主要内容：

Outline:

1.对本课程的实验内容的总结。

Lab review

2.拓展课程相关内容，学生做口头报告讲解讨论。

Further expand the class content. The students will do the presentation and discussion.

教学要求：

Requirements:

[掌握]

1.对本课程的实验内容的总结。

Lab review

2.查阅文献，深入拓展课堂内容

Consult the literature and further expand the class content

[熟悉]

1. 锻炼做口头报告，互动讨论。

Exercise for oral presentations and interactive discussion.

[了解]

1.归纳总结知识点，制作 PPT。

Summarize knowledge points and make PPT

2.团队合作。

Team work

重点、难点：拓展课堂内容。口头报告的表达能力。

Key and difficulty: further expand the class content and oral presentation skills.

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

Laboratory Exercises of Microbiology, 9th. (John P. Harley, 2013)

Laboratory Applications in Microbiology: A Case Study Approach. (Barry Chess, 2014)

Microbiology: A laboratory Manual, 10e. (James Cappuccino; Natalie Sherman, pearson, 2013)

Microbiology (Companion Site): A Human Perspective（Eugene Nester, Denise Anderson, C. Evans Roberts, Jr., 7/e，2012）

课程评估 ASSESSMENT

19.

评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		10	迟到一次扣 2 分 A deduction of 2 points for each time late.	
课堂表现 Class Performance		20		
小测验 Quiz		10		
课程项目 Projects		15		实验报告 Lab report
平时作业 Assignments		30		课堂笔记 Notebook
期中考试 Mid-Term Test				
期末考试 Final Exam		10		
期末报告 Final Presentation				
其它（可根据需要改写以上评估方式） Others (The above may be modified as necessary)		5		口头报告 Oral presentation

20. 记分方式 GRADING SYSTEM

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

课程审批 REVIEW AND APPROVAL

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

本课程经生物系本科教学指导委员会审议通过。
This Course has been approved by Undergraduate Teaching Steering Committee of Department of Biology.