**遗传学A 课程教学大纲**

**一、课程基本情况**

课程编号：01111460

课程总学时： 56，其中：讲课：56。

课程学分：3.5

课程分类：必修

开课学期：春

开课单位： 农学院 植物遗传育种与种子科学系

适用专业：植物生产类专业

所需先修课：植物学

课程负责人：刘庆昌

**二、课程目标**

**1、课程总目标**

遗传学是研究生物遗传和变异的一门科学，是生物科学中一门体系十分完整、发展十分迅速的理论科学，同时又是一门紧密联系生产实际的基础科学。《遗传学A》是植物生产类各专业的骨干基础课程，在这些专业的本科生培养中占有极为重要的地位。本课程全面系统地介绍遗传物质的结构与功能、遗传物质的传递、基因的表达与调控、生物的进化等，包括遗传的细胞学基础、遗传物质的分子基础、孟德尔遗传、连锁遗传和性连锁、基因突变、染色体结构变异、染色体数目变异、数量性状的遗传、近亲繁殖和杂种优势、细菌和病毒的遗传、细胞质遗传、基因工程、基因组学、基因表达的调控、遗传与发育、群体遗传与进化。通过本课程学习，要求学生全面掌握遗传学的基本概念、基本原理、基本分析方法，了解遗传学的最新发展，学会应用遗传学基本原理分析和解决一般遗传问题，为进一步学习育种学及其他有关课程奠定理论基础。

**2、课程分目标**

**课程分目标1：**

掌握遗传物质结构与功能的基本概念、基本原理，了解其最新发展。

**课程分目标2：**

全面掌握遗传物质传递的基本概念、基本原理、基本分析方法，了解其最新发展。学会应用遗传学基本原理分析和解决一般遗传问题。

**课程分目标3：**

掌握基因表达与调控的基本概念、基本原理、基本分析方法，了解其最新发展。

**课程分目标4：**

掌握生物进化的基本概念、基本原理、基本分析方法，了解其最新发展。

**二、课程目标与毕业要求的对应关系**

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| --- | --- | --- |
| **毕业要求** | **指标点** | **课程分目标** |
| 毕业要求2 | 2.2.2 掌握植物生产类专业基础理论、农学专业知识和实验研究方法，掌握现代生物技术的基本原理和方法  2.2.3 了解作物科学领域的最新动态和发展趋势 | 课程分目标1、2、3、4 |
| 毕业要求3 | 2.3.1 具有批判性思维和创新能力  2.3.2能够发现、辨析、质疑、评价作物科学领域的现象和问题，并提出个人见解 | 课程分目标2、3、4 |
| 毕业要求4 | 2.4.2 具有综合分析和研究作物生产中复杂问题的能力，提出相应对策和建议，并形成解决方案 | 课程分目标1、2、3、4 |

**三、课程内容、教学要求与课程目标关系图**

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| --- | --- | --- | --- |
| **课程模块** | **教学内容与教学要求** | **学时数** | **支撑的课程分目标** |
| 第一章：绪论 | 1、了解遗传学研究的对象和任务  2、熟悉遗传学的发展历史  3、熟悉遗传学的重要作用 | 2 | 课程分目标1 |
| 第二章：遗传的细胞学基础 | 1、了解细胞的结构和功能  2、掌握染色体的形态、结构和数目  3、掌握细胞周期与细胞分裂  4、熟悉配子的形成和受精  5、熟悉生活周期 | 3 | 课程分目标1 |
| 第三章：遗传物质的分子基础 | 1、熟悉DNA作为主要遗传物质的证据  2、掌握DNA和RNA的化学结构  3、掌握DNA的复制  4、掌握RNA的转录与加工  5、掌握遗传密码与蛋白质的翻译 | 3 | 课程分目标1 |
| 第四章：孟德尔遗传 | 1、掌握分离规律  2、掌握独立分配规律及其应用  3、掌握孟德尔规律的扩展 | 4 | 课程分目标2 |
| 第五章：连锁遗传和性连锁 | 1、掌握连锁和交换  2、掌握交换值及其测定  3、掌握基因定位与连锁遗传图  4、熟悉真菌类的连锁与交换  5、熟悉连锁遗传规律的应用  6、掌握性别决定与性连锁 | 4 | 课程分目标2 |
| 第六章：基因突变 | 1、熟悉基因突变的概念和意义  2、掌握基因突变的时期和特征  3、熟悉基因突变与性状表现  4、掌握基因突变的鉴定  5、掌握基因突变的分子机制  6、熟悉基因突变的诱发 | 4 | 课程分目标2 |
| 第七章：染色体结构变异 | 1、掌握缺失类型、细胞学鉴定、遗传效应  2、掌握重复类型、细胞学鉴定、遗传效应  3、掌握倒位类型、细胞学鉴定、遗传效应  4、掌握易位类型、细胞学鉴定、遗传效应  5、了解染色体结构变异的应用 | 4 | 课程分目标2 |
| 第八章：染色体数目变异 | 1、掌握染色体数目变异类型  2、掌握整倍体  3、掌握非整倍体 | 4 | 课程分目标2 |
| 第九章：数量性状的遗传 | 1、掌握数量性状的特征  2、掌握数量性状遗传研究的基本统计方法  3、掌握数量性状的遗传模型和方差分析  4、掌握遗传率的估算及其应用  5、熟悉数量性状基因座 | 4 | 课程分目标2 |
| 第十章：近亲繁殖和杂种优势 | 1、掌握近亲繁殖及其遗传效应  2、熟悉纯系学说及其发展  3、掌握杂种优势  4、了解近亲繁殖与杂种优势在育种上的利用 | 2 | 课程分目标2 |
| 第十一章：细菌和病毒的遗传 | 1、熟悉细菌和病毒的特点  2、熟悉噬菌体的遗传分析  3、掌握细菌的遗传分析：转化、接合、性导、转导 | 4 | 课程分目标2 |
| 第十二章：细胞质遗传 | 1、掌握细胞质遗传的概念和特点  2、熟悉母性影响  3、掌握叶绿体遗传  4、掌握线粒体遗传  5、熟悉共生体和质粒决定的染色体外遗传  6、掌握植物雄性不育的遗传 | 4 | 课程分目标2 |
| 第十三章：基因工程 | 1、熟悉基因工程的基本概念  2、掌握基因的分离  3、熟悉外源基因的导入  4、掌握转基因生物的检测与鉴定  5、熟悉基因工程的应用及其安全性评价 | 3 | 课程分目标2 |
| 第十四章：基因组学 | 1、熟悉基因组学的概念、研究内容及发展  2、掌握基因组图谱的构建  3、熟悉生物信息学  4、熟悉蛋白质组学 | 2 | 课程分目标3 |
| 第十五章：基因表达的调控 | 1、掌握基因的概念及其发展  2、掌握原核生物的基因表达与调控  3、掌握真核生物的基因表达与调控 | 4 | 课程分目标3 |
| 第十六章：遗传与发育 | 1、了解细胞核与细胞质在个体发育中的作用  2、熟悉基因对个体发育的控制  3、熟悉细胞的全能性 | 2 | 课程分目标4 |
| 第十七章：群体遗传与进化 | 1、掌握群体的遗传平衡  2、掌握影响群体遗传平衡的因素  3、了解生物进化学说及其发展  4、掌握物种的形成 | 3 | 课程分目标4 |

**四、考核方法**

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| --- | --- | --- | --- |
| **考核形式** | **分值** | **评分依据** | **对应课程分目标** |
| 作业 | 20 | 按时提交作业，作业认真程度，答案正确性 | 课程分目标1、2、3、4 |
| 阶段测验 | 30 | 根据答案要点及评分依据 | 课程分目标1、2 |
| 结课考试 | 50 | 根据答案要点及评分依据 | 课程分目标1、2、3、4 |

**五、使用教材或主要参考书**

刘庆昌主编，遗传学（第三版），2015，科学出版社，北京

执笔人：刘庆昌

审定人：刘庆昌，孙传清，鄂立柱

2016年9 月30日制定

**Genetics A**

**1. Basic information**

Course code: 01111460

Total teaching hours: \_\_56\_\_, among which\_\_56\_\_ hours for lectures, \_0\_ hours for experiments, \_\_0\_\_hours for on-line teaching.

Credits: 3.5

Type of the course: compulsory

Teaching terms: spring

Owner of the course: Genetics Teaching Group, Department of Plant Genetics, Breeding and Seed Science, College of Agronomy & Biotechnology

Majors applicable: Plant production

Prerequisites: Botany

Person in charge of the course: LIU Qing-chang

**2.** **Course Objectives**

**（1）General Aim**

Genetics is the science researching heredity and variation in living organisms, is not only theoretical science but also basic science greatly related to biological production. Genetics A is a key basic course for plant production majors, which plays an important role in these majors’ education. This course systematically describes the structure and function of genetic materials, transmission of genetic materials, expression and regulation of genes, and evolution of living organisms, covering cytological basis of inheritance, molecular basis of genetic materials, Mendel’s principles of inheritance, linkage and sex linkage, gene mutation, variations in chromosome structure and number, quantitative genetics, inbreeding and heterosis, genetics of bacteria and viruses, extrachromosomal genetics, gene engineering, genomics, gene expression and regulation, genetics and development, population genetics and evolution. Students are required to master fundamental concepts, principles, and analysis methods of Genetics, to understand advances of Genetics, and to resolve basic problems of Genetics.

**（2）Branch Objectives**

**The First one：**Master fundamental concepts and principles of genetic materials structure and function and understand their advances.

**The Second one：**Master fundamental concepts, principles, and analysis methods of genetic materials transmission, understand their advances, and resolve general genetics problems.

**The Third one：**Master fundamental concepts, principles, and analysis methods of gene expression and regulation and understand their advances.

**The Fourth one:** Master fundamental concepts, principles, and analysis methods of living organisms evolution and understand their advances.

**3. The Diagram between** **Course Content, Teaching Requirements and Course Objectives**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Modules | Course Content and Teaching Requirements | Class hours | Corresponding Course Objectives |
| Chapter 1 Introduction | 1. Understand contents and tasks of genetics  2. Understand history of genetics  3. Understand importance of genetics | 2 | The First one |
| Chapter 2 Cytological basis of inheritance | 1. Understand structure and function of cells  2. Master chromosome  3. Master cell cycle and cell division  4. Understand gamete formation and fertilization  5. Understand life cycle | 3 | The First one |
| Chapter 3 Molecular basis of genetic materials | 1. Understand genetic materials  2. Master chemical structures of DNA and RNA  3. Master DNA Replication  4. Master transcription and RNA processing  5. Master genetic code and translation | 3 | The First one |
| Chapter 4 Mendel’s principles of inheritance | 1. Master the principles of segregation  2. Master the principles of independent assortment  3. Master extensions of Mendel’s principles | 4 | The Second one |
| Chapter 5 Linkage and sex linkage | 1. Master linkage and crossing over  2. Master crossing over value  3. Master gene mapping and linkage maps  4. Understand linkage and crossing over in fungi  5. Understand application of linkage  6. Master sex determination and linkage | 4 | The Second one |
| Chapter 6 Gene mutation | 1. Understand concepts and importance of gene mutation  2. Master characteristics of gene mutation  3. Understand gene mutation and phenotypes  4. Master mutation detection and selection  5. Master molecular mechanism of gene mutation  6. Understand induction of gene mutation | 4 | The Second one |
| Chapter 7 Variations in chromosome structure | 1. Master types, cytological detection and genetic effects of deficiency  2. Master types, cytological detection and genetic effects of duplication  3. Master types, cytological detection and genetic effects of inversion  4. Master types, cytological detection and genetic effects of translocation  5. Understand application of variations in chromosome structure | 4 | The Second one |
| Chapter 8 Variations in chromosome number | 1. Master types of variations in chromosome number  2. Master euploid  3. Master aneuploid | 4 | The Second one |
| Chapter 9 Quantitative genetics | 1. Master characteristics of quantitative trait  2. Master some basic statistical notions  3. Master genetic models and variance analysis  4. Master heritability  5. Understand quantitative trait loci | 4 | The Second one |
| Chapter 10 Inbreeding and heterosis | 1. Master inbreeding and effects  2. Understand pure line theory  3. Master heterosis  4. Understand application of inbreeding and heterosis | 2 | The Second one |
| Chapter 11 Genetics of bacteria and viruses | 1. Understand characteristics of bacteria and viruses  2. Understand phage genetics  3. Master bacteria genetics: transformation, conjugation, sexduction, and transduction | 4 | The Second one |
| Chapter 12 Extrachromosomal genetics | 1. Master concepts and characteristics of extrachromosomal genetics  2. Understand maternal effect  3. Master genetics of chloroplasts  4. Master genetics of mitochondria  5. Understand genetics of symbionts and plasmids  6. Master plant male sterility | 4 | The Second one |
| Chapter 13 Gene engineering | 1. Understand concepts of gene engineering  2. Master isolation of genes  3. Understand transfer of genes  4. Master identification of transgenes  5. Understand application and safety evaluation of transgenes | 3 | The Second one |
| Chapter 14 Genomics | 1. Understand concepts of genomics  2. Master genomics  3. Understand bioinformatics  4. Understand proteomics | 2 | The Third one |
| Chapter 15 Gene expression and regulation | 1. Master gene concept and its development  2. Master regulation of prokaryotic gene expression  3. Master regulation of eukaryotic gene expression | 4 | The Third one |
| Chapter 16 Genetics and development | 1. Understand nucleus and cytoplasm and individual development  2. Understand genes and individual development  3. Understand totipotency and individual development | 2 | The Fourth one |
| Chapter 17 Population genetics and evolution | 1. Master genetic equilibrium  2. Master factors influencing genetic equilibrium  3. Understand evolutionary theory  4. Master speciation | 3 | The Fourth one |

**4. Methods of Assessment**

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| --- | --- | --- | --- |
| Evaluation Content | Score | Scoring Method | Corresponding Course Objectives |
| Schoolwork | 20 | Finished time and answer | Branch objectives 1, 2, 3, and 4 |
| Periodic Examination | 30 | Answer and its scores | Branch objectives 1 and 2 |
| Final Examination | 50 | Answer and its scores | Branch objectives 1, 2, 3, and 4 |

**5. Teaching materials or references:**

LIU Qing-chang (Editor-in-Chief): Genetics (Third Ed.), 2015, Science Press, Beijing

Written by: LIU Qing-chang

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