Department of Forestry

College of Agricultural Engineering Sciences

University of Salahaddin

Subject: Genetics

Course Book – Year 2

Lecturer's name: Dr. Namam Bahram Ismael

MSc. Zhala Baqi Taha

Academic Year: 2023 - 2024

Course Book

1. Course name	**Principles of Genetics**
2. Lecturer in charge	**Namam Bahram Ismael** **Zhala Baqi Taha**
3. Department/ College	**Forestry / Agricultural Engineering Sciences**
4. Contact	**e-mail:** namam.ismail@su.edu.krd **Tel: 07514495126** **e-mail:** zhala.taha@su.edu.krd **Tel:**
5. Time (in hours) per week	**Theory: 2** **Practical: 3**
6. Office hours	**8**
7. Course code	
8. Teacher's academic profile	**Theory** • **B.Sc. field crops - agricultural college- Mosul university - 1994** • **M.Sc. crop breeding from agricultural College- Salahaddin University - 2003** • **PhD in crop breeding- College of science- Mosul university – 2012.** **Practical** I finished my B.Sc. in Erbil Salahaddin University – Agriculture college- 2006-2007; I started working as a lab assistant in my university directly because I was the first one of the top student in plant production department, then I apply for post-graduation M.Sc. through (HCDP) program, finished it in Turkey kahramanmaras university – Bioengineering and science department. Nowadays I am working as assistant lecturer in agriculture college – Forestry department.
9. Keywords	**Genetics, cell biology, nucleic acid , mandals lows ,DNA molecule ,cell division ,DNA amplification, genetic engineering,**

10. Course overview:

Introduction and definitions of cytology, genetics and cytogenetic - history – cell theory and protoplasm theory, Cell – differences between plant cell and animal cell – differences between prokaryotic and eukaryotic cell, Chromosomes – morphology of chromosomes – shape, size and number of chromosomes – structure of chromosome .Deoxyribos Nucleic Acid (DNA) and its structure – Watson and Crick model –Modes of DNA replication , Genetic code – properties of genetic code – central dogma – outline of protein synthesis – transcription and translation, Arrangement of genes on chromosomes – linkage – definition – linkage groups, Crossing over – mechanism of crossing over –

types of crossing over – factors Mendelian genetics – terminology – Mendel's experiments – reasons for selection of pea as experimental material – characters studied – reasons for Mendel's success, Mendel's Laws – Law of segregation – Law of independent assortment –Principle of dominance – Principle of unit characters – exceptions to Mendel's Laws, Gene action – types of gene action , Qualitative and quantitative characters – definition – monogenic and polygenic inheritance and their differences – multiple factor hypothesis, Sex determination – various mechanisms of sex determination, Gene mutations – introduction – definition – brief history – terminology –classification of mutations and genetical engineering .plant breeding definition and its relationship with genetic . In general the aim of this lesson is learning student about genetics and its application in time now ,learning how prepare animal cell and plant cell and studding all structures in plant cell and animal cell ,and learning the division(mitosis and meiosis) , gametogenesis ,polyploidy ,pcr ,genetic engineering .

11. Course objective:

The principles of inheritance in plants and animals are presented with special attention devoted to the specific aspects of heredity. The goal of this course is to give the student a broad background in the science of heredity. The course includes the general topics of history of genetics, Mendelian genetics, molecular genetics and population genetics.
To impart knowledge to the students on the ultrastructure of cell and cell organelles, principles of genetics and their applications in plant breeding for improving agricultural productivity. Students can found the answers of these questions:

1) What is the genetic material ,cell, cell cycle?
2) What is the cell division mitoses?
3) meiosis division.
4) What is polyploidy?
5) What is genetic engineering?

By the end of the course, the students will be able to

1. understand the basic concepts of the ultrastructure of cell, cell organelles, chromosomes and nucleic acids
2. apply the principles of inheritance to plant breeding

acquaint with the fundamentals of chromosomal and cytoplasmic inheritance, sex determination, mutations and chromosomal aberrations

12. Student's obligation

In this part the role of students is as follow student attendance in lecture and examination, repairing reports about some important course subjects, preparing slides in lab ,doing daily quiz ,giving samples ,wearing lab coats in laboratory .and the student have to understand genetics, generations and traits , DNA and RNA, the role of mendils lows in genetics development.

13. Forms of teaching

1. Lecture

2. Self-study

Teaching Media

1. PowerPoint presentations
2. Texts and teaching materials
3.data show
4. white board

14. Assessment scheme

Theory: During the semester, the students are required to conduct two tests in theoretical lectures. There are 10 marks test and 5marks for activities, quizzes and 50 marks for final exam.

Practical:

1- student activities (Quiz & Reports)	**5%**
2- Test	**30%**

15. Student learning outcome:

Students will communicate effectively

b. use effective strategies to organize thoughts, develop a message and document sources for article reviews and the discussion web
c. learn to present a message skillfully when reviewing genetics articles
d. clearly and effectively express ideas and actively listen to the ideas of others during discussions

2. Students will think critically

a. read genetics articles and text with comprehension
d. evaluate and analyze arguments from more than one perspective in order to prepare for debates and discussions
e. recognize and form interpretations, generalizations, or causal explanations appropriate to the study of genetics

3. Students will have knowledge of human culture

a. identify, describe and use the salient methods, skills or ways of knowing in the fine arts, humanities, social sciences, mathematics and natural sciences
   i. Specifically genetic principles and applications
e. use available technologies to gather and process genetics information effectively

4. Students will be aware of their responsibilities to themselves, to humanity, to their planet and to their creator

a. examine personal lifestyle, ethics, integrity, values and priorities
b. respect individuals with beliefs, backgrounds or abilities different from their own
c. contribute to the welfare of their community and ecosystem

16. Course Reading List and References:

References:

1. Cell Biology, Genetics and Molecular Biology (2009). Dipak Kumar Kar and Soma Halder.
2. Cytogenetics, Evolution And Biostatistics (2007). R. S. Shukla and P. S. Chandel.
3. Genetics , analysis and principles (2005) . R. J. Brooker.
4. Principles of Genetics (2002). R. H. Tamarin.
5. Genetics (2000). L. H. Hartwell, L. Hood, M. L. Goldberg, A. E. Reynolds, L. M. Silver and R. C. Veres.

Practical

1. Brooker, R.J. 2008. Genetics: Analysis and Principles. McGraw Hill Companies Inc. U.S.A.
2. Pierce, B. 2008. Genetics. McGraw Hill Companies Inc. U.S.A.
3. Hartwell, L., Hood, L., Goldberg, M. and Reynolds, A. 2006. Genetics: From Genes to Genomes. McGraw Hill Companies Inc. U.S.A.

17. The Topics:	**Lecturer's name**
Theory 1st week: Genetics - History and development of genetical science - The genetics science branches. 2nd week: What is a chromosome - Chromosomes classification – Special types of chromosomes. 3rdweek: The nature of genetic material – primary structure of nucleic acids – Watson – crick model. 4th week: DNA Replication –replication models – the mechanism of replication - Protein synthesis. 5th week: Mendelian genetics - Advantages of using pea plants - Characters chosen by Mendel for his study- Explanation of Laws of Mendel. 6th week: Gene action – types of dominance- Lethal genes - types of Epistasis. 7thweek: Multiple alleles – blood groups – Rh system – sex genetics. 8th week: Linkage – crossing over – genetic maps . 9th week: quantitative genetics - genetic engineering. 10th week: Plant breeding - History and development of plant breeding- Correlated science with plant breeding- Objectives of Plant Breeding. 11th week : Scope of plant breeding- Activities in Plant Breeding. 12th week: General Methods of Plant Breeding 13th week: Heterosis - mutation breeding.	Dr. Namam Bahram

18. Practical Topics	
In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture **Week 1 :** What is genetic? What is chromosome? What is DNA? The cell, Components of the cell, Type of cells, Different between animal & plant cells, and Practical part prepare plant cells slide. **Week 2** : The cell cycle, Cell division, and Types of cell division. -prokaryotic cell division (Binary or direct cell division) - Eukaryotic cell division (indirect cell division) has two types: -Mitosis (Prophase, Metaphase, Anaphase, Telophase). **Week 3** : 2. Meiosis I:(A.Prophase I- B.Metaphase I- C. Anaphase I D.Telophase I). .Meiosis II (Prophase II, Metaphase II, Anaphase II, Telophase II).Comparison of Mitosis and Meiosis. **Week 4:** Mendelelian Genetics, Why peas, Pisum sativum? Mendel's Experimental Methods, Genetic Terminology, Genotype & Phenotype in Flowers, Types of Genetic Crosses, Generation "Gap". **Week 5:** Mendel's first law (Law of Segregation) plus example, Mendel's second law or law of independent assortment + example. **Week 6:** Gametogenesis in plant, Formation of female gametes, Double Fertilization. **Week: 7** What is DNA Extraction? Steps to DNA Extraction, DNA Source, practical	Zhala baqi

parts. **Week: 8** What are PCR polymerase chain reaction & the benefits + steps, practical parts? **Week: 9** Gel Electrophoresis, Steps Involved in Gel Electrophoresis. **Week: 10** Genetic Engineering, Selective Breeding, Recombinant DNA, Recombinant Bacteria, Benefits of Recombinant Bacteria. **Week: 11** How to Create a Genetically Modified Plant, How to Create a Transgenic plant. **Week: 12** Summary all semesters lecture before final exams.	

19. Examinations:

Sample of questions:

1. What is meaning about each of them?
    1. Incomplete dominance.
    2. Multiple alleles.
    3. Epitasis.
    4. Lethal alleles.

Incomplete dominance: In many cases, the intensity of phenotype produced by heterozygote is less than that produced by the homozygote for the concerned dominant allele.

Multiple alleles: a gene for particular character may have more than two allelomorphs same locus of the chromosome.

Epitasis: When expression of one gene depends on presence / absence of another gene in an individual, it is known as gene interaction. Interaction of genes at different loci that affect the same character is called epistasis.

The lethal genes may cause death of organism at any time in the life cycle of organism .

2. Choose the right answer

A cross between homozygous purple-flowered and homozygous white-flowered pea plants results in offspring with purple flowers. This demonstrates

a. the blending model of genetics.
b. true-breeding.

c. dominance.
d. dihybrid cross.

3. Complete the following blanks:

1.When a gene pair prevents the expression of other non-allelicgene,the gene which produced the effect called -----epistatic----and the gene whose expression is suppressed called ------hypostatic ------.

2. Dominance relationship is of the following types:

a. ---Complete dominance----like----garden pea, round seed shape is completely dominant over wrinkled----.
b. ----Incomplete dominance---- like----Mirabilis jalapa-----
c. ----Co-dominance---- like----The coat color of short horned breed of cattle----

4. **a.** How do we breed improved crop cultivars?

1. Inheritance of trait.
2. Understand the effect of reproductive behavior.
3. Transgenic varieties.

b. What are benefits of increased Vigor?

1. Increased yield
2. Better stand ability
3. Better germination
4. Overall better plant performance

Practical

1. Compositional:

Q1- What are the cell cycle and the aim of cell cycle?

2. True or false type of exams:

Q2- True or False :

1- Centromeres are the attachment point between sister chromatids in a chromosome.

3. Multiple choices:

Q3- Chose the correct answer:

1. An allele is:

A. Another word for a gene **B**. A homozygous genotype

C. A heterozygous genotype **D**. Two forms of a gene

20. Extra notes:

Some of the lectures will be presented in PowerPoint lecture will be provided in class.
Two textbooks (optional) are recommended for the genetics of the course.
Practical
This course book is containing just practical lectures that are given to two or more departments in agriculture college.

21. Peer review پێداچوونەوەی هاوەڵ

This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).

ئەم کۆرسبووکە دەبێت لەلایەن هاوەڵێکی ئەکادیمیەوە سەیر بکرێت و ناوەرۆکی بابەتەکانی کۆرسەکە پەسەند بکات و جەند ووشەیەک بنووسێت لەسەر شیاوی ناوەرۆکی کۆرسەکە و واژووی لەسەر بکات.
هاوەڵ ئەو کەسەیە کە زانیاری هەبێت لەسەر کۆرسەکە و دەبیت پلەی زانستی لە مامۆستا کەمتر نەبێت.