**UNIVERSITY OF SARGODHA**

**DEPARTMENT OF PLANT BREEDING AND GENETICS, COLLEGE OF AGRICULTURE**

COURSE OUTLINE **Fall 2020-21**

Course Title: **Introductory Genetics**

Course Code: PBG-201

Credit Hours: 3(2-1)

Instructor: Naeem Akhtar

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| **DESCRIPTION AND OBJECTIVES** |

This course is a introductory level of course for graduate students. The course aim is to explain the basic concept of genetics and different laws of genetics. The course contents enable the students to understand the mechanism of heredity. It also explains the chemical and molecular nature of nucleic acid. It also focuses on chromosomal aberrations and allelic and non-allelic interactions.

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| **INTENDED LEARNING OUTCOMES** |

The student will understands

1. Basic concepts of genetics
2. Mechanism of heredity
3. Effect of environment on organism
4. Chemical and molecular nature of gene

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| **COURSE CONTENTS** |

**Theory**

1. Definition of genetics, concepts of heredity and variation.
2. Cell and cell divisions.
3. Mendelian genetics: chromosome theory of heredity, various genotypic and phenotypic ratios and their modifications.
4. Differences between allelic and non-allelic interactions (epistasis), illustration of epistasis with suitable examples.
5. Pleiotropy and multiple allelism. Multiple factor hypothesis.
6. Linkage and crossing over.
7. Sex determination: sex linked and sex influenced traits.
8. Chromosomal aberrations.
9. Nucleic acids: nature, structure and function. Classical vs modern concepts of gene.

**Practical**

1. Study of cell divisions and gametogenesis.
2. Calculation of monohybrid and dihybrid ratios.
3. Numerical examples relating to gene interaction, multiple alleles and multiple factor inheritance.
4. Calculation of linkage from test cross and F2 data.

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| **READINGS** |

1. Sing, B.D. 2004. Genetics. Kalyani Publishers, New Delhi, India.
2. Klug, W.S. and M. R. Cummings. 2003. Concepts of Genetics. (7thed.) Pearson Education, Singapore.
3. Sing, P. 2003. Elements of Genetics. (2nded.) Kalyani Publisher, New Delhi, India
4. Rehman, A., A. Shakoor and M.A. Khan. 1980. Elements of Genetics. Deptt. Plant Breeding & Genetics, Univ. Agri. Faisalabad.
5. Pierce, B. A. Genetics- A conceptual approach. (2nded.) W. H. Freeman and Company. New York

COURSE SCHEDULE

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| **Week** | Topics and Readings |  |
| 1. | Distribution of teaching schedule and discussion about the course contents. Definition of genetics, concept of hereditary and variation. Cell Structure. | Week One |
| 2. | Discovery of cell and development of cell theory, sexual reproduction in plants and hybridization. Preformation and epigenesis theories about inheritance, Darwian’s hypothesis of pangenesis. Cell cycles, Mitosis | Week Two |
| 3. | Inheritance of acquired characters, germplasm theory of inheritance. Brief life sketch of Mendel, reasons for Mendel’s choice of pea plant for study of inheritance. Cell cycles, Meiosis | Week Three |
| 4. | Contrasting characters selected by Mendel for inheritance studies, law of segregation. law of segregation, Concept about dominant and recessive traits, alleles, phenotype, genotypes etc. Reproduction, Gametogenesis in animals | Week Four |
| 5. | Law of independent assortment. Law of independent assortment. Gametogenesis in plants | Week Five |
| 6. | Backcross and test cross with suitable examples. Blending Theory and particulate theory. Incomplete dominance with suitable examples. Exercise on genetic problems related to monohybrid segregation. | Week Six |
| 7. | Reasons for Mendel’s success, reasons for slow acceptance of Mendel’s work. Chromosomes theory of heredity, similarities between Mendel’s factors and chromosomes. Exercise on genetic problems related to monohybrid segregation. Formulae about number of kind of gametes genotypes, phenotypes, homozygotes, heterozygotes etc. Inheritance of albinism, taste blindness, eye colour, MN blood groups in human, difference between phenocopy and phenotype. Exercise on genetic problems related to dihybrid segregation. | Week Seven |
| 8. | Definition of lethal gene, examples of lethal gene in plants and animals. Exercise on genetic problems related to dihybrid segregation. | Week Eight |
| 9. | Definition and concept of gene interaction. Concept of recessive epistasis, dominant epistasis, examples about recessive and dominant epistasis. Genetic problems on epistasis | Week Nine |
| 10. | Duplicate recessive epistasis, duplicate dominant epistasis, examples of duplicate recessive and duplicate dominant epistasis. Dominant and recessive epistasis, factor interaction; examples about dominant and recessive epistasis, factor interaction, Mendelian 9:3:3:1 ratio resulting from factor interaction. Genetic problems on epistasis | Week Ten |
| 11. | Concept of multiple alleles, difference between multiple factors and multiple alleles. Examples of multiple alleles in human and plants, compound loci (*Pseudo alleles*), isoalleles. Genetic problems on multiple alleles  | Week Eleven |
| 12. | Sex chromosomes, autosomes, mechanisms of sex determination in human and animals. Concept of quantitative and qualitative traits, pleiotropy. Examples of quantitative traits in human and plants. Genetic problems on multiple alleles | Week Twelve |
| 13. | Use of binominal theorem in determination of various genotypic and phenotypic classes in F2 population. Concept about linkage of genes on chromosome and crossing over, linkage group, coupling and repulsion. Factors affecting crossing over, linkage studies in plants and drosophila. Genetic problems on quantitative inheritance | Week Thirteen |
| 14. | Detection of linkage, calculation of linkage and crossing over from test cross data. Calculation of linkage and crossing over from F2 data. Change by recombination, Change in chromosome number. Genetic problems on linkage and crossing over | Week Fourteen |
| 15. | Change in chromosome structure, Chemical changes in the chromosome, Classical concept of gene, structure of DNA and structure of gene according to modern concept. | Week Fifteen |
| 16. | Revision and Group Discussion | Week Sixteen |

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| **ASSESSMENT CRITERIA** |

Sessional: 20 (project, presentation, participation)

Mid exam: 30

Final exam with Practical: 50