

**P.G. Department of Botany**  
**Cluster University Srinagar**

**Semester-VI**  
**Discipline Specific Elective Course**  
**DSE-02B Genetics and Plant Breeding**  
**(Credits: Theory-4, Practical-2)**

**THEORY Lectures: 60 of one-hour duration / 90 lectures of 40 minutes**

**Unit 1: Heredity** **(16hours)**

Mendelian principles of inheritance; modified Mendelian ratios: 2:1- lethal Genes; 1:2:1- Co- dominance, incomplete dominance; 9:7; 9:4:3; 13:3; 12:3:1 and 15:1.  
Multiple allelism and pleiotropy with examples.  
Quantitative inheritance: concept, monogenic vs polygenic inheritance.

**Unit 2: Genes and Chromosomes** **(20 hours)**

Chromosomal theory of inheritance, Chromosomal mechanisms of sex-determination and sex-linked Inheritance.  
Linkage: concept; complete & incomplete linkage, Bridges experiment.  
Crossing over: concept and significance.  
Numerical changes in chromosomes— euploidy, aneuploidy  
Structural changes - deletions, duplications, inversions & translocations.

**Unit 3: Plant Breeding:** **(12hours)**

Concept and conservation of germplasm.  
Origin and domestication of crop plants with reference to rice and wheat.  
Plant introduction, acclimatization.  
Selection methods for self-pollinated, cross-pollinated and vegetatively propagated plants.

**Unit 4: Methods of crop improvement** **(12 hours)**

Polyploidy and distant hybridization - their role in crop improvement.  
of inbreeding depression and heterosis; applications.  
Inbreeding depression and heterosis - genetic basis

Hybridization techniques and utility in propagated plants; advantages & limitations.  
Concept of point mutations, their role in crop improvement.

**Practical**

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Problems based on Mendelian ratios and non-Mendelian ratios through probability reframe and Ch—square test. – 3:1 and 9:3:3:1.
3. Pedigree analysis for dominant and recessive autosomal and sex linked traits.

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4. Incomplete dominance and gene interaction through seed ratios (9:7, 13:3, 15:1, 12:3:1, 9:3:4).
5. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
6. Hybridization techniques - Emasculation, Bagging (For demonstration only).

**Suggested Readings:**

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. WileyIndia.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
5. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
6. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
8. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.
9. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
10. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.