



**Swami Shraddhanand College
(University of Delhi)**

Alipur, Delhi- 1100036

www.ss.du.ac.in

Lesson Plan

Name of Teacher	Prof. Bhoopander Giri (1 class/week) Dr. Bhawna Saxena (1 class/week)	Department	Botany
Course	B.Sc. (H) Botany	Semester	III
Paper	Genetic and Plant Breeding	Academic Year	2023-2024
Learning Objectives			
Learning Objectives: <ul style="list-style-type: none">▪ To apprise students with the basic principles of Genetics▪ To enhance the applications of genetics in plant breeding and agriculture.			
Learning Outcomes			
The Learning Outcomes of this course are as follows: On completion of the course the students will be able to: <ul style="list-style-type: none">• understand the fundamentals of Mendelian inheritance and its deviation in gene interactions.• describe the concepts of linkage and crossing over and their usage in constructing gene maps.			

- become familiar with pedigree analysis.
- learn about principles of population genetics
- gain knowledge about gene mutations and inherited disorders
- learn about various plant breeding techniques / methods

Lesson Plan

Week No.	Theme/ Curriculum
1. Week 1 (16 st -20 th Aug 23)	Orientation
2. Week 2 (21 st -27 th Aug 23)	<p>Unit 1. Mendelian Genetics Mendelism: History; Principles of inheritance (numerical) (Prof. Bhoopander Giri)</p> <p>Unit 2. Extra-Nuclear Inheritance Chloroplast and mitochondrial genomes (Semi-autonomous nature of genomes) (Dr. Bhawna Saxena)</p>
3. Week 3 (28 th -3 rd Sept 23)	<p>Unit 1. Mendelian Genetics Mendelism: deviations [Incomplete dominance (Mirabilis flower color) and codominance (MN Blood groups)] (Prof. Bhoopander Giri)</p> <p>Unit 2. Extra-Nuclear Inheritance Chloroplast Inheritance: Variegation in Four O'clock plant; Mitochondrial inheritance in yeast; Maternal effect (Shell coiling in Snails). (Dr. Bhawna Saxena)</p>
4. Week 4 (4 th -10 th Sept 23)	<p>Unit 1. Mendelian Genetics Chromosome theory of inheritance (points of parallelism); Multiple allelism (ABO blood groups) (Prof. Bhoopander Giri)</p> <p>Unit 3. Linkage, crossing over and chromosome mapping Linkage and crossing over (Discovery: Bateson & Punnett crosses in sweet pea) (Dr. Bhawna Saxena)</p>
5. Week 5 (11 th -17 th Sept 23)	<p>Unit 1. Mendelian Genetics lethal alleles (dominant lethal – Huntington's disease and recessive lethal Yellow coat color in mice)-(Prof. Bhoopander Giri)</p>

	<p>Unit 3. Linkage, crossing over and chromosome mapping Linkage and crossing over (explain crossing over using Morgan's two factor crosses - Black body & Vestigial wings, Complete Linkage, Incomplete Linkage) (Dr. Bhawna Saxena)</p>
<p>6. Week 6 (18th-24th Sept 23)</p>	<p>Unit 1. Mendelian Epistasis (all 6 gene interactions); Pleiotropy (definition, example PKU) (Prof. Bhoopander Giri) Unit 3. Linkage, crossing over and chromosome mapping Cytological basis of crossing over (Creighton and McClintock experiment in Maize) (Dr. Bhawna Saxena)</p>
<p>7. Week 7 (25th-1th Oct 23)</p>	<p>Unit 1. Mendelian Genetics Penetrance and expressivity (definitions, differences, one example: polydactyly) (Prof. Bhoopander Giri) Unit 3. Linkage, crossing over and chromosome mapping three factor crosses; interference and coincidence. (Dr. Bhawna Saxena)</p>
<p>8. Week 8 (2nd-8th oct 23)</p>	<p>Unit 1. Mendelian Genetics Polygenic inheritance (Nilsson-Ehle's crosses, definition, examples – skin colour, height, fruit weight; numericals) (Prof. Bhoopander Giri) Unit 3. Linkage, crossing over and chromosome mapping Sex linkage (Morgan's Red & White eye crosses in Drosophila). (Dr. Bhawna Saxena)</p>
<p>9. Week 9 (9th-15th oct 23)</p>	<p>Unit 1. Mendelian Genetics brief introduction to sex determination (Introduction to XX/XO in insects for discovery and XX/XY mechanism in human and Drosophila briefly, explain Barr body as consequence of Dosage Compensation) (Prof. Bhoopander Giri) Unit 5. Mutations Mutation types [spontaneous / induced, somatic / germinal, Biochemical, lethal, silent point (missense, non-sense, substitution, addition, deletion / indel, frameshift)] (Dr. Bhawna Saxena)</p>
<p>10. Week 10 (16th-22th Oct 23)</p>	<p>Unit 4. Variation in Chromosome number and structure Deletion; Duplication; Inversion (Prof. Bhoopander Giri) Unit 5. Mutations Muller's CIB method, Molecular basis of mutations (Tautomerism, Transitions, Transversions) Chemical mutagens (Base analogs,</p>

	deaminating, hydroxylating, alkylating and intercalating agents) and Physical mutagens (Ionising and Non ionising radiations)(Dr. Bhawna Saxena)
11. Week 11 (23 th -29 th Oct 23)	<p>Unit 4. Variation in Chromosome number and structure</p> <p>Translocation (Definition, mechanism and one example) (Prof. Bhoopander Giri)</p> <p>Unit 5. Mutations Transposable genetic elements and their significance (Definition, how TEs cause mutations, examples of Transposons in different organisms, (Dr. Bhawna Saxena))</p>
12. Week 12 (30 th -5 th Nov 23)	<p>Unit 4. Variation in Chromosome number and structure</p> <p>Translocation (Definition, mechanism and one example) (Prof. Bhoopander Giri)</p> <p>Unit 5. Mutations Types - copy-paste, cut paste, one example of Barbara McClintock, Ac-Ds Elements - Maize kernel color to explain the mechanism. (Dr. Bhawna Saxena)</p>
13. Week 13 (6 th -12 th Nov 23)	<p>Unit 4. Variation in Chromosome number and structure</p> <p>Euploidy and aneuploidy (In Brief) (Prof. Bhoopander Giri)</p> <p>Unit 6. Population and evolutionary genetics Hardy Weinberg law (Allele frequencies, genotype frequencies) (Dr. Bhawna Saxena)</p>
14. Week 14 (13 th -19 th Nov 23)	<p>Unit 7. Plant Breeding</p> <p>Plant breeding- Principle and Practices, domestication and plant introduction (primary and secondary introduction) (Pof. Bhoopander Giri)</p> <p>Unit 6. Population and evolutionary genetics</p>

	Hardy Weinberg law numericals based on it (Dr. Bhawna Saxena)
15. Week 15 (20 th -26 th Nov 23)	Unit 7. Plant Breeding selection and its types: pure line selection, mass selection and clonal selection (Prof. Bhoopander Giri) Unit 6. Population and evolutionary genetics Speciation - sympatric & allopatric speciation, (modes of speciation and genetics of speciation). (Dr. Bhawna Saxena)
16. Week 16 (27 th -3 rd Dec 23)	Unit 7. Plant Breeding hybridizations (inter-specific and intra-specific with examples in cultivated crops: Origin of Triticum aestivum, Raphanobrassica/Rabbage, 4x and 6x Triticale, Gossypium hirsutum (amphidiploid New World cotton) (Prof. Bhoopander Giri) Revision-(Dr. Bhawna Saxena)
17. Week 17 (4 th -6 th Dec 23)	Unit 7. Plant Breeding heterosis and its significance (Definition of heterosis and its advantages/significance) (Prof. Bhoopander Giri) Revision-(Dr. Bhawna Saxena)
Suggested Readings	
Books	Suggested Readings: 1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8 th edition. New Delhi, Delhi: John Wiley & sons. 2. Griffiths, A.J.F., Doebley, J., Peichel, C, Wassarman D (2020). Introduction to Genetic Analysis, 12 th edition. New York, NY: W.H. Freeman and Co. 3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2020). Concepts of Genetics, 12 th edition. San Francisco, California: Benjamin Cummings.

	<p>4. Pierce, B. A. (2020). Genetics: A Conceptual Approach, 7th Edition, Macmillan</p> <p>5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A., Minorsky P.V., Jackson, R.B. (2020). Biology. San Francisco, SF: Pearson Benjamin Cummings.</p> <p>6. Singh, B.D., (2022). Plant Breeding: Principles and Methods. New Delhi, Medtech Publishers</p> <p>Additional Resources:</p> <p>1. Russell. P. J. (2010). Genetics- A Molecular Approach. 3rd Edition. Benjamin Cummings</p> <p>2. Snustad, D.P., Simmons, M.J. (2016). Principles of Genetics, 7th Edition. New Delhi, Delhi: John Wiley & sons</p> <p>3. Hartl, D.L., Ruvolo, M. (2019). Genetics: Analysis of Genes and Genomes, 9th edition, Jones and Bartlett Learning.</p> <p>4. Singh, B. D. (2023). Fundamentals of Genetics, 6th edition. MedTech.</p>
--	--

Assignment and Class Test Schedule for Semester

Assignments: Submission by 30th October 2023

Class Test: As per the College mid-semester exam schedule