CURRICULUM PLAN 2024-25

Dr. Ranjana Roy Mishra

(ODD Semesters: I, III, V)

NEP Implemented in Semester I, III & V

B. Sc. (H) Botany Semester III NEP

Discipline Specific Core Course – 9: Genetics and Plant Breeding

Paper code- 2162012303

(July- December 2024)

Name of Paper	Allocation of Lectures/ 08 hours	Month wise schedule followed by the Department	Tutorial/Assignment etc.	Suggested readings
Discipline Specific Core Course – 9: Genetics and Plant Breeding				
Unit 1. Mendelian Genetics Mendelism: History; Principles of inheritance (numericals), deviations [Incomplete dominance (Mirabilis flower color) and codominance (MN Blood groups)]; Chromosome theory of inheritance (points of parallelism); Multiple allelism (ABO blood groups); lethal alleles (dominant lethal – Huntington's disease and recessive lethal - Yellow coat color in mice); Epistasis (all 6 gene interactions); Pleiotropy (definition, example PKU); Penetrance and expressivity (definitions, differences, one example: polydactyly); Polygenic inheritance (Nilsson-Ehle's crosses, definition, examples - skin colour, height, fruit weight; numericals); 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).	08 hours	August 2024	Quiz test on google Classroom	1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition. 2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition. 3. Klug, W.S., Cummings, M.R., Spencer,

				C.A. (2012). Concepts of Genetics. Benjamin Cummings, U.S.A. 10th edition. 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.
Unit 2. Extra-Nuclear Inheritance Chloroplast and mitochondrial genomes (Semi-autonomous nature of genomes); Chloroplast Inheritance: Variegation in Four O`clock plant; Mitochondrial inheritance in yeast; Maternal effect (Shell coiling in Snails). **Unit 3. Linkage, crossing over and chromosome mapping** Linkage and crossing over (Discovery: Bateson & Punnett crosses in sweet pea, explain crossing over using Morgan's two factor crosses - Black body & Vestigial wings, Complete Linkage, Incomplete Linkage), Cytological basis of crossing over (Creighton and McClintock experiment in Maize); three factor	**2 hours** **5 hours**	September 2024 September 2024	Presentation by students	

crosses; interference and coincidence; Sex linkage (Morgan's Red & White eye crosses in *Drosophila*).				
Unit 4. Variation in Chromosome number and structure Deletion; Duplication; Inversion; Translocation (Definition, mechanism and one example); Euploidy and aneuploidy (In Brief)	**4 hours**	September 2024	Presentation by students	
Unit 5. Mutations Mutation types [spontaneous / induced, somatic / germinal, Biochemical, lethal, silent; point (missense, non-sense, substitution, addition, deletion / indel, frameshift)]; Muller's CIB method, Molecular basis of mutations (Tautomerism, Transitions, Transversions); Chemical mutagens (Base analogs, deaminating, hydroxylating, alkylating and intercalating agents) and Physical mutagens (Ionising and Non ionising radiations); Transposable genetic elements and their significance (Definition, how TEs cause mutations, examples of Transposons in different organisms, Types - copy-paste, cut paste, one example of Barbara McClintock, Ac-Ds Elements - Maize kernel color to explain the mechanism.	**4 hours** **3 hours**	Mid September to October 2024		
Unit 6. Population and evolutionary genetics Hardy Weinberg law (Allele frequencies, genotype frequencies) and numericals based on it; Speciation - sympatric & allopatric speciation, (modes of speciation and genetics of speciation).	**4 hours**	Mid October to November 2024		

Unit 7. Plant Breeding Plant breeding- Principle and Practices, domestication and plant introduction (primary and secondary introduction), selection and its types: pure line selection, mass selection and clonal selection; 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), heterosis and its significance (Definition of heterosis and its advantages/significance).		November 2024		

PRACTICALS

1. To study meiosis in *Allium cepa* through squash preparation of anthers.	August 2024
2. To study mitosis in *Allium cepa* through squash preparation of root tips.	August2024
3. To understand the deviations of Mendelian dihybrid ratios (12:3:1, 9:3:4, 9:7, 15:1,	August 2024
13:3, 9:6:1) involved using the seed mixture given. Genetic ratio to be calculated using Chi square analysis.	September 2024
4, Human Genetics:	
a) Study of autosomal & sex-linked dominant & recessive inheritance through pedigree analyses.	September 2024
b) ABO blood group testing using kits,	
c) To study the syndromes (Down's, Klinefelter's, Turner's, Edward's & Patau) through karyotypes	September 2024
5. To calculate allelic and genotypic frequencies of human dominant and recessive traits using Hardy- Weinberg's principle.	October 2024
6. To study Xeroderma pigmentosum, Sickle cell anaemia, albinism, haemophilia and colour blindness (Ishihara charts may be used to study colour blindness)	October 2024
7. To study chromosomal aberrations:	
a) Quadrivalents, lagging chromosomes, dicentric/inversion bridge through photographs / permanent slides	October 2024
b) Reciprocal translocation through photograph/permanent slides/squash preparations of *Rhoeo* anthers.	November 24

8. Demonstration of basic methods of plant breeding (hybridizations): Emasculation, bagging and tagging using available plant material in pots/gardens/field. 9. Mock and Final Practical Exam	November 24 November 24

B.Sc. (Hons) Botany
Semester I: (NEP)
Plant Diversity and Evolution (BOT- DSC-1)
(August 29- December 2024)

S.No	Practical	Schedule
1	To study structure of TMV and Bacteriophage (electron micrographs/models).	September 2024
2	To study morphology of *Volvox*, *Oedogonium*, *Chara*, *Fucus* and *Polysiphonia* (Temporary preparation/specimens/slides).	September 2024
3	To study *Rhizopus*, *Penicillium*, *Alternaria* (Temporary preparations), symptoms of rustof wheat, white rust of crucifer (specimen).	September 2024
4	To study *Marchantia* (morphology, WM of rhizoids and scales), *Anthoceros*(morphology), *Sphagnum* (morphology, WM of leaf), *Funaria* (morphology WM of rhizoid and leaf).	October 2024
5	To study *Selaginella* (morphology, WM of strobilus and spores), *Equisetum* (morphology, WM of spores), *Pteris* (morphology, tease mount of sporangia and spores).	October 2024
6	To study *Cycas* (morphology, leaf, leaflet anatomy, coralloid root, bulbils, megasporophyll and microsporophyll); *Pinus* (morphology of dwarf shoot, needle anatomy, male and female cones, WM pollen grains).	October 2024
7	To study variation in leaf venations in dicots and monocots (at least two specimens each).	November 2024
8	To study the types of inflorescences in angiosperms (through specimens).	November 2024
9	To study the types of fruits in angiosperms (through specimens).	December 2024
10	Mock and Final Practical Exam	December 2024

B.Sc. (Hons) Botany
Semester I: (NEP)
Cell Biology: Organelles and Biomolecules (BOT-DSC-2)
(August 29- December 2024)

S.No	Practical	Schedule
1.	Study of cell and its organelles with the help of electron micrographs and other digitalresources.	September 2024
2	Study of plant cell structure with the help of epidermal peel mount of *Allium*/*Rhoeo*/*Crinum*.	September 2024
3	Microchemical tests for carbohydrates (reducing, non-reducing sugars and starch), lipidsand proteins.	September 2024
4	Separation of chloroplast pigments by paper chromatography/ Thin LayerChromatography.	October 2024
5	Separation of amino acids by paper chromatography.	October 2024
6	Study the effect of organic solvent and temperature on membrane permeability.	October 2024
7	Demonstration of the phenomenon of protoplasmic streaming in *Hydrilla* leaf	November 2024
8	Demonstration of the phenomenon of plasmolysis and deplasmolysis.	November 2024
9	Demonstration of separation of biomolecules by dialysis.	December 2024
10.	Mock and Final Practical Exam	December 2024