

CURRICULUM PLAN 2025-26
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
(01 August- December 2025)

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 2025	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., Doebbley, 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).	2 hours	September 2025	Presentation by students	
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	5 hours	September 2025		

crosses; interference and coincidence; Sex linkage (Morgan's Red & White eye crosses in <i>Drosophila</i>).				
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 2025	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	Mid September to October 2025		
	3 hours	Mid September to October 2025		
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 2025		

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 <i>Triticum aestivum</i> , Raphanobrassica/Rabbage, 4x and 6x Triticale, <i>Gossypium hirsutum</i> (amphidiploid New World cotton), heterosis and its significance (Definition of heterosis and its advantages/significance).		November 2025		
PRACTICALS				
1. To study meiosis in <i>Allium cepa</i> through squash preparation of anthers. 2. To study mitosis in <i>Allium cepa</i> through squash preparation of root tips. 3. To understand the deviations of Mendelian dihybrid ratios (12:3:1, 9:3:4, 9:7, 15:1, 13:3, 9:6:1) involved using the seed mixture given. Genetic ratio to be calculated using Chi square analysis. 4, Human Genetics: a) Study of autosomal & sex-linked dominant & recessive inheritance through pedigree analyses. b) ABO blood group testing using kits, c) To study the syndromes (Down's, Klinefelter's, Turner's, Edward's & Patau) through karyotypes 5. To calculate allelic and genotypic frequencies of human dominant and recessive traits using Hardy- Weinberg's principle. 6. To study Xeroderma pigmentosum, Sickle cell anaemia, albinism, haemophilia and colour blindness (Ishihara charts may be used to study colour blindness) 7. To study chromosomal aberrations: a) Quadrivalents, lagging chromosomes, dicentric/inversion bridge through photographs / permanent slides b) Reciprocal translocation through photograph/permanent slides/squash preparations of <i>Rhoeo</i> anthers.				August 2025 August 2025 August 2025 September 2025 September 2025 September 2025 October 2025 October 2025 October 2025 November 25

8. Demonstration of basic methods of plant breeding (hybridizations): Emasculation, bagging and tagging using available plant material in pots/gardens/field.	November 25
9. Mock and Final Practical Exam	November 25

B.Sc. (Hons) Botany SemV (NEP)
Molecular Biology of the Cell – DSC 13
(August - December 2025)

S.No	Practicals	Schedule
1.	Isolation of plasmid and genomic DNA from <i>E. coli</i> and quantification using agarose gel electrophoresis	August 2025
2.	To estimate the generation time of <i>Escherichia coli</i> (prokaryote) and budding yeast (eukaryote) by spectrophotometric measurement and plotting growth curve as an indirect method to study DNA replication	August 2025
3.	Isolation of genomic DNA from plant samples (atleast two different genera / species) using CTAB method and quantification using agarose gel electrophoresis	August 2025
4	Quantification of unknown DNA by diphenylamine reagent (colorimetry).	September 2025
5	To study control of replication in budding yeast with the help of specific inhibitors (beta-lactams:- Clavulanic acid, Ceftazidime, Piperacillin, Ceftriaxone etc) and studying budding frequency.	September 2025
6	To study control of transcription in <i>Escherichia coli</i> with the help of prokaryotic (Rifampicin) and eukaryotic (Actinomycin-D) transcription inhibitors and plotting growth curve	September 2025
7	To study control of translation in <i>Escherichia coli</i> with the help of prokaryotic (Kanamycin / Streptomycin) inhibitors using an IPTG-	October 2025

	inducible system.	
8.	To understand the regulation of lactose (<i>lac</i>) operon (positive & negative regulation) and tryptophan (<i>trp</i>) operon (Repression and De-repression & Attenuation) through digital resources/data sets.	October 2025
9	Mock and Final Practicals	November-December 2025

B.Sc. (Prog) Life Science BOT-LS- DSC-1
Semester I: (NEP)
Plant Diversity and Systematics

S.No	Practicals	Schedule
1	Viruses: EM of TMV and Bacteriophage, Specimens of virus infected plants (any two).	August 2025
2	Bacteria: EM of a bacterium, types through permanent slides/photographs, specimens of infected plants (any two).	August 2025
3	Algae: Study of vegetative and reproductive structures of (a) <i>Nostoc</i> (b) <i>Volvox</i> (c) <i>Spirogyra</i> through temporary preparations and permanent slides.	August 2025
4	Fungi: Study of vegetative and reproductive structures of (a) <i>Rhizopus</i> , (b) <i>Penicillium</i> , and (c) <i>Agaricus</i> through temporary preparations and permanent slides/specimens/photographs.	August 2025
5	Lichens: Crustose, Foliose and Fruticose (specimens/photographs).	August 2025
6	Bryophytes: Study of (a) <i>Marchantia</i> morphology of thallus, W.M. rhizoids and scales, V.S. thallus through gemma cup, W.M. gemmae (all temporary slides), V.S. antheridiophore, archegoniophore, L.S. sporophyte (all permanent slides), (b) <i>Funaria</i> : detailed study and classification from W.M. rhizoids, operculum, peristome, spores and permanent slides of archegonia, antheridia and capsule.	September 2025
7	Pteridophytes: Study of <i>Pteris</i> : T. S. of Rachis, V.S. of Sporophyll and W.M. of sporangium. Gymnosperms: Study of <i>Pinus</i> morphology of long & dwarf	September 2025

8	shoot, male and female cones (specimens) and T.S. of needle (permanent slides only).	September 2025
9	Herbarium technique (Mounting of a properly dried and pressed specimen of any wild plant on the herbarium sheet with complete herbarium label).	October 2025
10	Taxonomic study of characters of 1 plant from each of the following families (any four): Malvaceae, Solanaceae, Asteraceae, Fabaceae, and Liliaceae	October 2025
11	Mock and Final Practical Exam	November 2025