



JYOTI NIVAS COLLEGE AUTONOMOUS BANGALORE – 560 095
DEPARTMENT OF BOTANY
B.Sc. VI SEMESTER BOTANY PAPER VII SYLLABUS (2021 NEP BATCH)
GENETICS AND PLANT BREEDING

COURSE TITLE	GENETICS AND PLANT BREEDING
COURSE CODE	21VIBO7 (T)
COURSE CREDITS	04
TOTAL CONTACT HOURS	60 Hours
DURATION OF ESE	2 ½ Hours
CONTINUOUS INTERNAL ASSESSMENT (CIA)	40 Marks
END SEMESTER EXAMINATION (ESE)	60 Marks

COURSE OBJECTIVES:

- Understand the Mendelian and neo Mendelian genetics.
- To Know about interaction of genes, multiple alleles and linkage and crossing over.
- To Know about the evolutionary sequence of various groups of plants.

LEARNING OUTCOMES:

- Discuss the basics of Mendelian genetics, its variations and interpret inheritance of traits in living beings.
- Elucidate the role of extra-chromosomal genetic material for inheritance of characters.
- Understand the application of principles and modern techniques in plant breeding.
- Recognition of modes of inheritance of traits/ phenotypes and Phenotype-genotype correlation

Learning Outcomes:

CO NO.	Course outcomes statement	Knowledge level
1.	Explain nutrient uptake mechanisms and hormone functions in plants.	K2
2.	Discuss the symbiotic relationships in plant communities and their ecological significance.	K3
3.	Analyze how environmental factors influence plant growth and development.	K4
4.	Evaluate the consequences of human activities on plant biodiversity and ecosystems.	K5
5.	Identify and understand plant defense mechanisms against pathogens and pests.	K2
6.	Illustrate and explain the factors influencing seed germination.	K3
7.	Comprehend and apply genetic engineering techniques to enhance plant traits.	K4

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓								
CO2		✓		✓						✓
CO3	✓	✓		✓						✓
CO4	✓	✓	✓				✓		✓	

Programme Objectives aligned with Graduate Attributes

- PO1: Knowledge
- PO2: Scientific thinking
- PO3: Entrepreneurial skills
- PO4: Analytical skills
- PO5: Communication skills
- PO6: Social commitment
- PO7: Research and Inquiry
- PO8: Conservation of Environment
- PO9: Digital awareness and literacy

- PO10: Academic orientation

Unit 1:**15 Hrs.**

Mendelian genetics – Introduction, History, Laws and concepts

Non-Mendelian genetics - Allelic (Incomplete Dominance and Co-dominance) and non-allelic gene interactions (complementary, supplementary factors, dominant and recessive epistasis) and Multiple alleles. Extra chromosomal inheritance Chloroplast mutation: variegation in Four o'clock plant.

Mitochondrial mutations in yeast.

Unit 2**18 Hrs.**

Linkage, crossing over and chromosome mapping

Linkage and crossing over - Cytological basis of crossing over; Recombination frequency.

Sex Determination in plants – *Melandrium*. Variation in chromosome number and structure

Gene mutations –Types, Molecular basis of Mutations; Mutagens – physical and chemical. Fine

Structure of gene

Population Genetics - Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection and mutation

Evolutionary Genetics – Genetic drift. Genetic variation and Speciation.

Unit 3**15 Hrs.**

Plant Breeding: Introduction and objectives, Heterosis. Breeding systems: modes of reproduction in crop plants. Methods of crop improvement - Plant introduction, primary and secondary

Plant genetic resources - Acclimatization

Selection methods: For self-pollinating and cross pollinating crops Types of vegetative propagation in Plants.

Unit 4**12 Hrs.**

Quantitative inheritance: Concept, mechanism, examples of inheritance of Kernel colour in Wheat, Monogenic vs Polygenic inheritance. Hybridization – Types, Procedure, advantages and limitations.

Crop improvement and breeding: Role of mutations, Polyploidy and role of biotechnology in crop improvement.

BOTANY PRACTICAL PAPER–VII

COURSE TITLE	GENETICS AND PLANT BREEDING
COURSE CODE	21VIBO7 (P)
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 hours/week
DURATION OF ESE	03 hours
CONTINUOUS INTERNAL ASSESSMENT (CIA)	25 Marks
END SEMESTER EXAMINATION (ESE)	25 Marks

Experiments

1. Plant breeding:

2. Vegetative reproduction – Cutting, Budding, , grafting and layering
3. Hybridization: Emasculation, bagging, pollination and production of hybrids
4. Pollen fertility – Tetrazolium test (Pollen of *Vinca rosea*)

Genetics:

5. Mendel's laws through seed ratios (monohybrid and dihybrid crosses)
6. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3).
7. Incomplete dominance and gene interaction through seed ratios (15:1, 12:3:1, 9:3:4).
8. Genetic problem on Linkage (8+9)
9. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes (Photocopies). Plant examples
10. Photographs showing Translocation Ring, Laggards and Inversion Bridge.

Filed visit – Plant Nursery for Vegetative propagation.

REFERENCES

1. Botter. Text Book of Genetics. L.B. Publications.
2. Chahal. Principles and Procedures of Plant Breeding. L.B. Publications.
3. Gopalakrishnan, T.S., Itta Sambasivaiah & Kamalakar Rao. Principles of organic evolution.
4. Gupta, P.K. Cytology, Genetics & Evolution. Rastogi Publication.
5. Hughes. Plant Molecular Genetics. L.B. Publications.
6. Khanna, S.S. Genetics, Heredity & Evolution.
7. Klug. Concept of Genetics. 7th Ed. L.B. Publications.
8. Singh. Cytology & Genetics. L.B. Publications.
9. Sinha and Sinha. Cytogenetics, Plant Breeding & Evolution. Vikas Publications.
10. Sinnot, E.W. Dunn, L.C. & Dobzonsky, T. (1958). Principles of Genetics. Tata Mac Graw Hill, New York.
11. Stickburger, M. (1990). Genetics 3rd (Eds.). MacMillan Publishing Company.