

Course	Year	Semester
<i>Diploma Course in Developmental Botany</i>	<i>B.Sc. II</i>	<i>IV</i>

**Paper 1: Cytogenetics and Plant Breeding (course code: BOT401 T)**

**Credit 4 Course outcomes:**

1. Understand the structure and chemical composition of chromatin and concept of cell division.
2. Interpret the Mendel's principles; acquire knowledge on cytoplasmic inheritance and sex- linked inheritance.
3. Understand the plant breeding systems and heterosis and mutation in plant breeding.

Unit	Topic	No. of Lectures (60 hrs)
<b>1</b>	<b>Heredity:</b> (Pre-mendelian genetics, brief life history of Mendel, laws of Inheritance, modified mendelian ratios, lethal genes, co-dominance,	<b>15</b>

	incomplete dominance, chi square, pedigree analysis, multiple allelism, chromosome theory of inheritance, sex-determination and sex-linked inheritance, cytoplasmic inheritance <b>Linkage and crossing over:</b> Linkage: concept and history, complete and incomplete linkage, bridges experiment, coupling and repulsion, recombination frequency, linkage maps based on two and three factor crosses.	
<b>2</b>	<b>Crossing over:</b> Concept and significance, cytological proof of crossing over; mutations and chromosomal aberrations (types of mutations, effects of physical and chemical mutagens, numerical chromosomal changes: euploidy, polyploidy and aneuploidy; structural chromosomal changes: deletions, duplications, inversions and translocations).	<b>15</b>
<b>3</b>	<b>Plant breeding:</b> introduction and objectives; breeding systems, important achievements and undesirable consequences of plant breeding; methods of crop improvement; centres of origin and domestication of crop plants, plant genetic resources; acclimatization; selection methods.	<b>15</b>
<b>4</b>	<b>Hybridization:</b> for self, cross and vegetatively propagated plants – procedure, advantages and limitations; inbreeding depression and heterosis (history, genetic basis of inbreeding depression and heterosis; applications); crop improvement and breeding (role of mutations; polyploidy; distant hybridization and role of biotechnology in crop improvement).	<b>15</b>

### Suggested readings

- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. (2014). Molecular Biology of the Cell. Garland Publishing Inc., New York. 6<sup>th</sup> edition.
- Gardner, E.J., Simmons, M.J. and Snustad, D.P. (1991). Principles of Genetics, John Wiley & Sons.
- Hartwell, L.H., Hood, L., Goldberg, M.L., Reynolds, A.E., Silver, L.M., Veres, R.C. (2006). Genetics-From Genes to Genomes, McGraw Hill
- Lewin, B. (2008). Genes IX, Jones and Barlett Publishers.
- Lodish, H., Berk, A., Zipursky, S.L., Maztsudaira, P., Baltimore, Dand Darnell, I. (2016). Molecular Cell Biology (8<sup>th</sup> Edition). W.H. Freeman and Co., New York, USA.
- Rastogi, V.B. (2019). Genetics. 4<sup>th</sup> Edition. MEDTECH: A Division of Scientific International.
- Russel P. J. (2010). Genetics-A Molecular Approach, Pearson Education Inc.
- Singh R. J. (2002). Plant Cytogenetics, CRC Press.
- Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7<sup>th</sup> edition.
- Strickberger M.W. (2008). Genetics, Pearson (Prentice Hall).
- Watson, J.D. (2013). Molecular Biology of the Genes, Benjamin. 7<sup>th</sup> Edition.

## **Paper 2: Practical/Lab Course (Course code: BOT402 P)**

### **Credit 4: Course outcomes**

1. Interpret the Mendel's principles; and understand the monohybrid and dihybrid crosses and their ratio and chromosomal changes.
2. Learn the basic structure and function of cells and instruments used in molecular biology.

<b>Unit</b>	<b>Topic</b>	<b>No. of Lectures (60 hrs)</b>
<b>1</b>	Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square. Monohybrid cross (dominance and incomplete dominance) Dihybrid cross and gene interactions. Pedigree analysis for dominant and recessive autosomal and sex linked traits. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4). Contribution of Mendel.	<b>15</b>
<b>2</b>	Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes through photographs. Photographs/permanent slides showing translocation ring, laggards and inversion bridge.	<b>15</b>
<b>3</b>	Hybridization techniques - Emasculation, Bagging (For demonstration only). Induction of polyploidy in plants (For demonstration only).	<b>15</b>
<b>4.</b>	Techniques used for Crop Improvement. Contribution of Dr. M.S. Swaminathan, T.S. Venkataraman, B.P. Pal, Dharampal Singh, V. Santhanam in plant breeding.	<b>15</b>

### **Suggested readings**

- Singh, R.J. (2021). Practical Manual on Plant Cytogenetics. CRC Press, Taylor and Francis Group, Routledge.