

**MAHATMA GANDHI UNIVERSITY**

**B.Sc. BOTANY PROGRAMME**

**Semester V**

**Course 7**

**BO5B07U**

**GENETICS, PLANT BREEDING AND HORTICULTURE**

**(Theory 54 hours ; Practical 45 hours)**

**(Theory Credit 3, Practical Credit1)**

**Course Objectives**

1. Understand the basic principles of heredity
2. Understand the inheritance pattern of nuclear and extra nuclear genes
3. Understand the methods of crop improvement
4. Understand the importance of horticulture in human welfare

**GENETICS**

**(Theory 25 hrs)**

**Module 1.**

**2 hours**

Origin of a new branch of Biology- Genetics- Mendelian era; basic laws of inheritance, Mendelian ratios

**Module 2.**

**8 hours**

Growth of Genetics- post Mendelian period- modified Mendelian ratios; incomplete dominance-flower color in *Mirabilis*: Interaction of genes- comb pattern in poultry (9:3:3:1): Epistasis- recessive- coat color in mice (9:3:4); dominant epistasis- fruit color in summer squash (12:3:1): complementary genes- flower color in *Lathyrus* (9:7).

**Module 3.**

**2 hours**

Multiple alleles- general account: ABO blood group in man; co dominance; self sterility in *Nicotiana*.

**Module 4**

**2 hours**

Quantitative characters- polygenic inheritance, continuous variation- kernel color in wheat; ear size in maize.

**Module 5**

**4 hours**

Linkage and crossing over- importance of linkage, linkage and independent assortment. Complete and incomplete linkage. Crossing over- general account, cytological basis of crossing over- two point test cross; determination of gene sequences; interference and coincidence; mapping of chromosomes.

**Module 6**

**4 hours**

Sex determination- sex chromosomes and autosomes- chromosomal basis of sex determination; XX-XY, XX-XO mechanism; sex determination in higher plants (*Melandrium album*); genic balance theory of sex determination in *Drosophila*; sex chromosomal abnormalities in man- Down's syndrome, Klinefelter's syndrome, Turner's syndrome- Sex linked inheritance- eye color in *Drosophila*, Haemophilia in man; Y-linked inheritance.

**Module 7**

2 hours

Extra nuclear inheritance- general account- maternal influence- plastid inheritance in *Mirabilis*, cytoplasmic male sterility in plants, kappa particle in *Paramecium*.

**Module 8**

1 hour

Population genetics-Hardy Weinberg law

**PLANT BREEDING**

**(Theory: 15 hours)**

**Module 1**

1 hours

Introduction and objectives of plant breeding.

**Module 2**

1 hours

Plant introduction- procedure of plant introduction, quarantine regulations, acclimatization- agencies of plant introduction in India, major achievements..

**Module3**

2 hour

Selection- mass, pureline, clonal- genetic basis of selection-achievements.

**Module 4**

5 hours

Hybridization- procedure- intergeneric, interspecific and intervarietal hybridization.with examples- composite and synthetic varieties- heterosis in plant breeding, inbreeding depression; genetics of heterosis and inbreeding depression; single cross, pedigree method, bulk population method, multiple cross, back cross, polyploidy breeding, male sterility in plant breeding. Use of apomixis in plant breeding.

**Module 5**

2 hours

Mutation breeding- methods- achievements in India; breeding for pest, disease and stress resistance

**Module 5**

2 hours

Modern tools for plant breeding; Genetic Engineering and products of genetically modified crops

**Module 6**

2 hours

Modern tools for plant breeding; Genetic engineering and products of Genetically modified crops

**HORTICULTURE**

**(Theory: 14 hours )**

**Module 1**

2 hours

Introduction to horticulture- definition, history, classification of horticultural plants, disciplines of horticulture; Garden tools and implements. Irrigation methods- surface, sub, drip and spray irrigations, mist chambers- advantages and disadvantages

## Module 2

6 hours

Propagation of horticultural plants- by seeds- Seed viability, seed dormancy, seed testing and certification, seed bed preparation, seedling transplanting, hardening of seedling; advantages and disadvantages of seed propagation. Vegetative propagation- organs used in propagation- natural and artificial vegetative propagation; methods- cutting, layering, grafting and budding; advantages and disadvantages of vegetative propagation.

## Module 3

6 hours

Gardening- ornamental gardens, indoor gardens, kitchen gardens- terrestrial and aquatic gardens- garden adornments; garden designing- garden components- lawns, shrubs and trees, borders, hedges, edges, walks, drives- famous gardens of India; Landscape architecture- home landscape design, parks. Physical control of plant growth- training and pruning; selection of plant for bonsai, bonsai containers and method of bonsai formation

## Practical

45 hours

### A. Genetics

27 hours

a. Students are expected to work out the problems in:

1. Monohybrid , dihybrid cross and back crosses.
2. All types of modified Mendelian ratios mentioned in the syllabus.

b. Study of human karyotype and study of characteristic karyotypes and symptoms of the syndromes mentioned in the syllabus

### B. Plant breeding

9 hours

1. Emasculation and bagging
2. Comparison of percentage of seed germination and the effect of any one chemical on the rate of elongation of radicle in any three crop seeds

### C. Horticulture

18 hours

1. Tongue grafting, budding ('T' and patch), air layering
2. Identification of different garden tools and their uses
3. List out the garden components in the photograph of the garden given
4. Preparation of potting mixture in the given proportion

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#### Websites

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