

stakeholders, linkages, economics, ecotourism auditing. Problems with ecotourism. Carrying capacity of ecotourism. ecotourism facilities – Green report card. Ecotourism management – issues.

Module 8: Ecotourism and livelihood security (4 hrs)

Community, biodiversity conservation and development – Eco-development committees.

REFERENCES

1. A K Bhattacharya, 2005. *Ecotourism and Livelihoods*. Concept Publ. company, New Delhi.
2. Kreg Lindberg, Deonal E. Hawkins, 1999. *Ecotourism: A guide for planners and managers*. Natraj Publishers, Dehradun.
3. Batta A., 2000. *Tourism and environment*. Indus Publishing Co., New Delhi.
4. Cater E, 1994. *Ecotourism in the third world: Problems and prospects for sustainability*. In: E. Cater and G. Lowman (Ed.) *Ecotourism: a sustainable option*, Wiley, Chichester.
5. Croall J, 1995. *Preserve or Destroy: Tourism and Environment*. Calouste Gulbenkian Foundation, London.

SEMESTER VI

Core course 9

Code: BO6CRT09

GENETICS, PLANT BREEDING AND HORTICULTURE

(Theory 54 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Imparting an insight into the principles of heredity
- Understand the patterns of inheritance in different organisms
- Understand the inheritance pattern of nuclear and extra nuclear genes
- Understand the methods of crop improvement
- Understand the importance of horticulture in human welfare
- Develop skill in gardening technique among students

GENETICS (Theory 27 hrs; Practical 27 hrs)

Module 1: Origin and development of Genetics (3 hrs)

Genetics as a science: origin - experiments of Mendel with *Pisum sativum*, general terminology used in genetics. Principles of inheritance, Mendelian laws - monohybrid and dihybrid cross, test cross and backcross.

Module 2: Exceptions to Mendelism (10 hrs)

Modification of Mendelian ratios: incomplete dominance - *Mirabilis*; Co-dominance - MN blood group in man; Lethal genes – pigmentation in Snapdragon..

Geneic interaction: epistasis, (a) Dominant - fruit colour in summer squashes (b) Recessive - coat colour in mice; Complementary genes - flower colour in sweet pea. Non-epistasis - comb pattern in Fowls. Multiple alleles – ABO blood groups in man; self sterility in *Nicotiana*.

Module 3: Linkage of genes (3 hrs)

Linkage and crossing over: chromosome theory of linkage; crossing over - types of crossing over, mechanism of crossing over. Linkage map - 2 point cross, interference and coincidence.

Module 4: Determination of sex (6 hrs)

Sex determination: sex chromosomes and autosomes; chromosomal basis of sex determination; XX-XY, XX-XO mechanism; sex determination in higher plants (*Melandrium album*). Sex linked

inheritance: X-linked - Morgan's experiment e.g. eye colour in *Drosophila*, Haemophilia in man; Y-linked inheritance; sex limited and sex influenced inheritance. Pedigree analysis.

Module 5: Quantitative inheritance (2 hrs)

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

Module 6: Extra-chromosomal inheritance (2 hrs)

Extra chromosomal inheritance: chloroplast mutation - variegation in 4O'clock plant; mitochondrial mutations in yeast. Maternal effects - shell coiling in snail; infective heredity - kappa particles in *Paramecium*.

Module 7: Population genetics (1 hr)

Concept of population, gene pool, Hardy-Weinberg principle (brief).

PRACTICAL (18 hrs)

1. Students are expected to work out at least two problems each from: monohybrid, dihybrid, back-cross and test cross; all types of modified Mendelian ratios mentioned in the syllabus.

PLANT BREEDING (Theory 13 hrs; Practical 9 hrs)

Module 1: Introduction to plant breeding (1 hr)

Introduction and objectives of plant breeding. Plant breeding centers in Kerala, their achievements – CPCRI, CTCRI, RRII.

Module 2: Plant introduction (2 hrs)

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

Module 3: Selection (2 hrs)

Plant Selection: mass, pure-line, clonal.

Module 4: Hybridization (4 hrs)

Hybridization: types, procedure, important achievements. Heterosis in plant breeding, inbreeding depression, genetics of heterosis and inbreeding depression. Handling segregating generation - pedigree method, bulk method, back cross method. Disease resistance breeding.

Module 5: Mutation breeding and polyploidy breeding (2 hrs)

Mutation breeding: methods, applications and important achievements. Polyploidy breeding: methods and applications.

Module 6: Tissue culture as method in plant breeding (2 hrs)

Application of meristem culture, embryo culture and pollen culture in plant breeding. Role of tissue culture in the creation of transgenic plants.

PRACTICAL (9 hrs)

1. Emasculation and bagging.
2. Demonstration of hybridization in plants.
3. Estimation of pollen sterility/viability.

HORTICULTURE (Theory 14 hrs; Practical 18 hrs)

Module 1: Introduction (3 hrs)

Introduction to horticulture - definition, history. Classification of horticultural plants. Disciplines of horticulture - pomiculture, olericulture, floriculture, arboriculture.

Garden implements - budding knife, secateurs, hedge shear, hand cultivator, sprayers, lawn mower, garden rake, spade.

Irrigation methods: surface, sub, drip and spray irrigations; mist chambers - advantages and disadvantages.

Module 2: Plant propagation: (5 hrs)

Seed propagation: seed testing and certification, seed bed preparation, seedling transplanting, hardening of seedling; advantages and disadvantages of seed propagation. Vegetative propagation: natural and artificial; artificial methods - cutting, layering, grafting and budding, micro-propagation; advantages and disadvantages of vegetative propagation.

Module 3: Gardening (6 hrs)

Types of garden: brief study on ornamental garden, indoor garden, kitchen garden, aquatic garden, vertical garden, medicinal garden, terrace garden, terrarium.

Garden designing: garden components - lawns, shrubs and trees, borders, topiary, hedges, edges, walks, drives.

Physical control of plant growth: training and pruning. Bonsai - selection of plant - bonsai containers and method of bonsai formation.

Plant growing structures: green house, orchidarium, conservatory; Potting mixture – components.

PRACTICAL (18 hrs)

1. Approach grafting (demonstration only), budding (T, 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. Visit to established horticultural/agricultural/ornamental/kitchen gardens and observe the components there.

REFERENCES

1. Adams C R, Bamford K M, Early M P, 2004. *Principles of Horticulture* (V Edn). Elsevier, Linacre House, Jordan Hill, Oxford OX2 8DP, UK.
2. Edmond J B, Senn T L, Andrews F S, Halfacre P G, 1975. *Fundamentals of Horticulture* (IV Edn). TMHN, Delhi.
3. Jules Janick, 1979. *Horticultural Science*. Surjeet publications, New Delhi.
4. Kumar N, 1994. *Introduction to Horticulture*. Rajalakshmi Pub. Nagarcoil.
5. Manibhushan Rao K, 2005. *Text Book of Horticulture* (II Edn). Macmillan India Ltd.
6. Randhawa G S, Mukhopadhyay A, 1986. *Floriculture in India*. Allied Publishers Pvt. Ltd. Ahmedabad.
7. Sadhu M K, 1989. *Plant propagation*. New age international publishers, N. Delhi.
8. Schilleter J C, Richey H W, 2005. *Text Book of General Horticulture*. Biotech Books, New Delhi.
9. Shukla R S, Chandel P S, 2004. *Cytogenetics Evolution and Plant breeding*. S. Chand & Co. Ltd. New Delhi.
10. Singh B D, 2015. *Plant breeding* (X Edn). Kalyani publishers, New Delhi.
11. West R, 1999. *Practical Gardening in India*. Discovery Pub. House, New Delhi.
12. Sinnot E W, Dunn L C, Dodzhansky T, 1958. Principles of genetics.
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15. William Hexter, Henry T Yost Jr., 1977. The science of Genetics.
16. Laura Livingston Mays, 1981. Genetics: A Molecular approach. Macmillan publishing company.
17. Benjamin A P, 2005. *Genetics: a conceptual approach* (II Edn). W H Freeman and Company, New York.
18. Snustad D P, Simmons M J, 2012. *Principles of genetics* (VI Edn). John Willey and sons, USA.
