MANONMANIAM SUNDARANAR UNIVERISTY,
TIRUNELVELI-12

SYLLABUS

UG - COURSES – AFFILIATED COLLEGES

Course Structure for B.Sc. Botany
(Choice Based Credit System)
(with effect from the academic year 2020-2021 onwards)

Semester-VI				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
III	Core VIII	Genetics, Evolution and Biostatistics		4
III	Core IX	Plant Physiology		4
III	Core X	Microbiology		3
III	Elective I	Horticulture and Plant Breeding - I(A)		2
		Forestry - I(B)		
III	Elective II	Plant Biotechnology and Genetic Engineering - II(A)		2
		Environmental Biotechnology - II(B)		
III	Major Practical VII	Genetics, Evolution, Biostatistics and Elective – I Practical		3
III	Major Practical VIII	Plant Physiology - Practical		2
III	Practical IX	Microbiology and Elective II - Practical		2

Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

A. **Scheme for internal Assessment**:
Maximum marks for written test: **20 marks**
3 internal tests, each of **I hour** duration shall be conducted every semester.
To the average of the **best two** written examinations must be added the marks scored in. The **assignment** for 5 marks.

The break up for internal assessment shall be:
Written test- 20 marks; Assignment -5 marks Total - 25 marks

B. Scheme of External Examination
3 hrs. examination at the end of the semester
A – Part : 1 mark question two - from each unit
B – Part : 5 marks question one - from each unit
C – Part : 8 marks question one - from each unit

- **Conversion of Marks into Grade Points and Letter Grades**

S.No	Marks	Letter Grade	Grade point (GP)	Performance
1	90-100	O	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	A	8	Very Good
4	60-69	B+	7	Good
5	50-59	B	6	Above Average
6	40-49	C	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

- **Cumulative Grade Point Average (CGPA)**

$$\mathbf{CGPA} = \frac{\mathbf{\Sigma\,(GP \times C)}}{\mathbf{\Sigma C}}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

- **Classification**
  a) First Class with Distinction : CGPA $\geq$ 7.5*****
  b) First Class : CGPA $\geq$ 6.0
  c) Second Class : CGPA $\geq$ 5.0 and $<$ 6.0
  d) Third Class : CGPA$<$ 5.0

GENETICS, EVOLUTION AND BIOSTATISTICS

Objectives:

- To learn the pattern of inheritance.
- To understand the mechanism of gene action.
- To learn the concept of Biostatistics.
- To become aware of the importance of statistical tools in life sciences.

UNIT – I

Mendel's laws of heredity with reference to Monohybrid and Dihybrid crosses. Test cross - Monohybrid and Dihybrid. Incomplete dominance - Monohybrid and Dihybrid. Lethal gene action in Maize and Mice.

UNIT – II

Interaction of genes; Supplementary genes, Complementary genes and Duplicate factors. Polygenic inheritance with reference to ear length in corn.

UNIT – III

Molecular structure of DNA, Replication of DNA - Semi conservative method, Proof for DNA as genetic material, Genetic code, Sex determination in plants.

UNIT – IV

Evolutionary theories - Lamarckism, Darwinism, Mutation theory of Devries, Speciation.

UNIT – V

Collection and interpretation of data, Mean, Median, Mode, Standard deviation & Chi-square test.

PRACTICAL:

1. To work out simple genetic problem in Monohybrid, Dihybrid, Incomplete dominance, Lethal genes and Interaction of genes.
2. Using available data to find out the Mean and Standard deviation and to draw frequency curve / histogram.
3. To work out simple Chi-square problems.
4. To record variation: Intra / Inter specific.
5. Spotters: Models and Charts: DNA structure, Replication of DNA, use and disuse theory of Lamarck, Natural selection theory - Struggle for existence.

To maintain a record note book for external evaluation.

REFERENCES:

1. Gupta. P.K., 1991, Genetics, Rastogi Publications, Meerut.
2. Gupta. P.K., 2004, Cell and Molecular Biology, Rastogi Publications, Meerut.
3. John Jothi Prakash. E. and David Paulraj M., 2007, Genetics and Biostatistics, JPR Publications, Neyyor.
4. Verma. P.S. and Agarwal. V.L., 1991, Genetics, S.Chand and Co., NewDelhi.

PLANT PHYSIOLOGY

Objectives:

- Understand the various functions of the plants.
- Know the mechanisms of thevarious activities.
- Relates the role of phytohormones on growth and development of plants.

UNIT – I

Water Relations: Imbibition, Diffusion, Osmosis and Plasmolysis; Water Potential- Definition, Components, Absorption of Water –Mechanism and Factors affecting Water Absorption; Transpiration- Definition, Types, Significance and Mechanism of Stomatal Transpiration- steps and theories, Guttation

UNIT – II

Ascent of Sap –Definition, Path of Ascent of Sap, Mechanism- Transpiration Pull and Cohesion Theory; Mineral nutrition: Macro and Micro nutrients - Absorption of Mineral Salts – Mechanism; Translocation of Organic Solutes: Mechanism - Munch's Mass flow hypothesis.

UNIT – III

Photosynthesis: Light and Dark Reactions - Photosynthetic Electron Transport Chain and Photophosphorylation (Cylic and Non cyclic); Carbon Assimilation - C3, and C4 Pathways and its Significance; Respiration: Types, Glycolysis, Kreb's cycle and Oxidative Phosphorylation.

UNIT – IV

Growth Curve and phases of growth; Phytohormones: Physiological Effects and Practical applications - Auxin, Gibberellic acid, Cytokinin, Ethylene and Abscisic acid;

UNIT – V

Seed dormancy: Causes and Methods of breaking seeddormancy; Photoperiodism and Vernalization.

PRACTICAL:

1. 1.Water Potential by Falling Drop Method.
2. Osmotic Potential by Plasmolytic Method.
3. Rate of Photosynthesis in Different Concentrations of Bi-Carbonate – Bubble Method.
4. Determination of Respiratory Quotient (R.Q) using Ganong's Respirometer.
5. Effect of Temperature on Permeability of Plasma Membrane.
6. Separation of Chlorophyll Pigments by Ascending Paper Chromatography.

DEMONSTRATION:

1.Tissue Tension; 2. Suction due to Transpiration; 3. Fermentation; 4. Arc Auxanometer; 5. Clinostat; 6. Phototropism

Spotters

1. 1.Absorption Spectrum of Chlorophylls
2. Growth curve.
3. Growth hormone

Maintain a record note book for external valuation

REFERENCES:

1. Devlin, R.M. (1969). Plant Physiology. Holt, Rinehart & Winston & Affiliated East West Press (P) Ltd., New Delhi.
2. DulsyFatima, R.P. et. al., (1994). Elements of Biochemistry.Saras Publications, Nagercoil, Tamil Nadu.
3. Jain, V.K. (1990). Fundamentals of Plant Physiology. S. Chand & Co., New Delhi. Noggle, R. and Fritz (1989). Introductory Plant Physiology.Prentice Hall of India. Pandey, S.N. (1991). Plant Physiology.Vikas Publishing House (P) Ltd., New Delhi.
4. Periyasamy, K. (1978). Cell IyakkaViyal(Cell Physiology). Tamil Nadu text Book Society, Chennai.
5. Salisbury, F.B. and Ross, C.W. (1999). Plant Physiology. CBS Publishers and Printers, New Delhi.

MICROBIOLOGY

Objectives:

- The paper aims to impart knowledge of bacteriology and virology including classification, structure, multiplication, transmission, foodborne pathogens, waterborne pathogens and microbial control.
- The paper aims to give the students broad theoretical knowledge in industrial microbiology and agricultural microbiology.

UNIT – I

Characteristic Features of Archaea, Bergey's Classification of Bacteria, Characteristic Features, Morphology, Cellular Structure, Metabolism, Growth and Reproduction, Bacterial Culture, and Staining. Characteristic Features of Actinomycetes, Rickettsia, and Mycoplasma, Characteristic Features of Cyanobacteria

UNIT – II

Baltimore Classification of Viruses, Characteristic Features of Viruses, Structure, Replication, and Transmission.ICTV Classification of Bacteriophages, Structure, and Replication.Detailed Study of CaMV and Coronavirus.Virus Related Agents: Viroids, Virusoids, and Prions

UNIT – III

Microbial Production of Acetic Acid, Amylase, Ethanol, Glutamic Acid, Insulin, Penicillin, and Vitamin B12, Vaccines Types, and Vaccination

UNIT – IV

Fermented Foods: Beer, Bread, Cheese, Yogurt, and Wine, Microbial Spoilage of Foods and Preservation Methods, Food Poisoning by Bacteria, Viruses and Protozoa and Prevention, Agents for Microbial Control

UNIT – V

Microbial Aerosols, Microflora of Soil and Water, Bacteriological Air and Water Analyses, Role of Microbes in Improving Soil Fertility, Role of Microbes in BiologicalNitrogen Fixation, Microbial Phosphorus Solubilization.

PRACTICAL

1. Sterilization by Moist Heat – Autoclave/ Pressure Cooker
2. Sterilization by Dry Heat - Hot Air Oven
3. Preparation of Nutrient Agar Medium
4. Preparation of Serial Dilutions
5. Plating Methods: Pour Plate, Spread Plate, and Streak Plate
6. Isolation of microbes from soil and water

7. Simple Staining
8. Gram'sStaining
9. Hanging Drop Method to Test Bacterial Motility
10. Methylene Blue Reduction Test to Determine the Quality of milk Sample

Identification of Lab-ware and Equipment

1. Autoclave
2. Pressure Cooker
3. Hot Air Oven
4. Incubator
5. Cavity Slide
6. Micropipette
7. Inoculation Loop
8. L-rod
9. Petri plate
10. Nutrient Agar Plate
11. Nutrient Agar Slant
12. Microscopic Images of Bacteria, Cyanobacteria, Fungi, and Viruses
13. Spoiled Foods and Preserved Foods

REFERENCE

1. Ananthanarayan and Paniker. 2020. Textbook of Microbiology. 11th ed. Universities Press India Pvt. Ltd.
2. Aneja K.R., 2017. Fundamental Agricultural Microbiology.New Age International Publishers.
3. Baveja C.P. 2021. Textbook of Microbiology. 6th Ed. Arya Publications
4. Dubey R.C and MaheshwariD.K. 2010.Textbook of Microbiology.S.Chand and Company Ltd.
5. L E Casida, J.R. 2019. Industrial Microbiology.2nd Ed.New Age International Publishers.
6. Pelczar J.M., Chan E.C.S. and Kreig.R.N. 2001. Microbiology. Indian Ed.McGraw Hill Education.
7. Rangaswami G. Bagyaraj D.J., 1992.Agricultural Microbiology.2nd Ed. Prentice-Hall India Learning Private Limited.
8. Reddy, S.M., Girisham, S., NarendraBabu, G., Vijaypal Reddy, B. 2017.Applied Microbiology. Scientific Publishers.
9. William C Frazier and Dennis C Westhoff.2017.Food Microbiology. McGraw Hill Education.

HORTICULTURE & PLANT BREEDING

Objectives:

- Develop skills in horticultural practices and techniques.
- Learn to construct kitchen garden and ornamental gardens.
- Gain a knowledge of the techniques of producing desirable plants through hybridization

UNIT – I

Scope, importance and divisions of horticulture; Gardening: Definition and objectives – different types of gardening – Formal, informal and kitchen garden.

UNIT – II

Propagation methods: Cutting – root, stem and leaf; Layering – ground and air layering, grafting – tongue and approach grafting; Budding – T budding and Patch budding; Vegetative propagules - bulb, sucker, corm. Seed Propagation: Preparation of Nursery beds, Transplantation – steps and Methods.

UNIT – III

Garden components: Lawn, Hedges, Edges, Rockery, Topiary, water garden, Bonsai and Hanging basket. Garden implements - spade, water can, pruning scissors, digging fork

UNIT – IV

Nature, Scope and Objectives of Plant Breeding; Plant introduction - selection methods (pure line and mass), Hybridization techniques, Heterosis breeding, Interspecific and intergeneric hybridization.

UNIT – V

Mutation Breeding: Procedure and practices, Mutagens, Polyploidy breeding and its applications. Breeding for disease resistance.

PRACTICALS:

i. Vegetative methods of propagation.

a) Cutting-Stem and Leaf cutting
b) Layering-Simple and air layering.
c) Grafting - Tongue grafting.
d) Budding - T-budding.

ii. Garden components -Rockery, hanging baskets, and topiary.

iii. Garden implements - spade, water can, pruning scissors, digging fork

iv. Designing Kitchen Garden.
v. Plant Breeding: Emasculation and Bagging methods.
Maintain a record note book for external valuation.

References:

1. Allard, R.W. (1960). Principles of Plant Breeding. John Wiley & Sons, NewYork.
2. Bose, T.K., Maiti, R.G.,Dhua, R.S.and Das, P.(1999).FloricultureandLandscaping.NayaPrakash, Calcutta.
3. Chopra, V.L. (1989). Plant Breeding. Oxford IBH, New Delhi.
4. Kumar,N.(1997).Introduction to Horticulture.Rajalakshmi Publication, India. ManibhushanRao, K. (1991). Text Book of Horticulture. MacMillan Publications, New Delhi.
5. Mukherjee, D.(1972). Gardening in India. Oxford & IBH Publishing Co., Kolkatta, Mumbai, New Delhi.
6. Roy Choudhry, N.andMishra, H.P.(2001). Text book on Floriculture and Landscaping. RajaInfoTech Enterprise, India.
7. Sharma, J.R.(1994). Principles and Practice of Plant Breeding. Tata McGraw Hill, NewDelhi.

FORESTRY

Objectives:

- To aware the knowledge of Forest
- To learn about forest, forest Products and utilization and valuable Forest Products.

UNIT – I

Forests - Introduction, physiography, vegetation, Forest types, Role of forests-distribution and classification. (Champion and Seth's Classification) Forest as balanced ecosystem, status of Indian Forests-Indian Forest policy.

UNIT – II

Forest degradation – Damage caused by fire, climatic factors, and injuries by insects, plants, animals and diseases, activities of man including encroachment and shifting cultivation.

UNIT – III

Forest management and Conservation-Regeneration Tending Operations – Sustainable utilization forest resources – Forest organizations. Role of remote Sensing in Forest management.

UNIT – IV

Agro Forestry – objectives – advantages and disadvantages. Recreational forestry – role of botanical gardens, zoos, National Parks and sanctuaries.

UNIT – V

Forest utilization – Harvesting, conservation, storage and Disposal of wood in Forest; major and minor Forest Products; Forest based Industries_ Paper and pulp industry; resin tapping and turpentine manufacture; Forest education in India.

PRACTICAL

1. Identify and find out the uses of wood samples of common timbers
2. Prepare maps showing forest types in India and Tamil Nadu.
3. Collect and study the remote sensing images showing forest vegetation in India and Tamil Nadu.
4. Prepare Photographs of different forest types.
5. Study the commonly used important forest Products.

To maintain a Record for external valuation.

REFERENCES

1. Agarwal – Forest in India
2. Bore, N.C – Manual of Indian Forest Botany
3. DWivedi, A.P – Forestry in India.
4. Sagreiya, K.P – Forest and Forestry
5. TribhawanMetha- A Hand book of Forest utilization.

PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING

Objectives:

This paper helps the students to understand the totipotency of the cells and the tissue culture techniques, to learn the fundamental principles in gene cloning, various methods of gene transfer, screening and the use of vectors in gene transfer technology for the desired characteristics.

UNIT – I

Tissue culture: Introduction, definition, history, scope and importance of plant tissue culture, Totipolency of cells, Tissue culture laboratory - organization and requirements, sterilization techniques, Nutrient media-composition and preparation. Apical meristem culture, callus culture, Embryo culture, Anther culture.

UNIT – II

Protoplast culture: Protoplast isolation, culture and fusion, selection of hybrids and regeneration. Cybrids- production and applications. Artificial Seed - production, advantages and disadvantages. Tissue culture application including micropropagation, androgenesis, production of virus free plants, Secondary metabolite production, germplasm conservation, cryopreservation and usages.

UNIT – III

Enzymes and Vectors for Genetic Manipulations: Restriction endonuclease - types, biological role, mechanism and usage in cloning; Restriction Mapping - linear and circular; Ligase enzymes. Cloning vectors -basic sequence of any vector; types of bacterial vector - Ti plasmid, pBR 322, BAC; Viral vector - Lambda page, phagemid, cosmid and Yeast vector.

UNIT – IV

Gene Cloning and Methods of Gene transfer: Basic concept of Gene cloning, advantages of gene cloning, bacterial transformation methods and selection of recombinant clones using various strategies, PCR-mediated gene cloning; Gene Construct; Plant transformation vector, T-DNA and viral vector, Agrobacterium-mediated Transformation protocols, molecular mechanism of T-DNA transfer, direct gene transfer method by Electroporation, Microinjection, Microprojectile bombardment.

UNIT – V

Major concerns and Applications of Transgenic Technology: Transgenic technology and sustainable agriculture, Biosafety concerns with transgenic technology. Applications as Pest resistant (BT-cotton); herbicide resistant plants (Roundup Ready Soybean); Transgenic crops with improved quality traits in major crops (FlavrSavr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug)

PRACTICAL: Spotters/ Photographs

1. Callus culture from Carrot explant, apical meristem culture, embryo culture and anther culture
2. Protoplast Isolation
3. Plasmids-Ti plasmids
4. Gene cloning in E. coli
5. Agrobacterium mediated gene transfer
6. Direct gene transfer by electroporation, microinjection, microprojectile bombardment
7. Transgenic plants prescribed in the syllabus.

To maintain a record

REFERENCES

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory andPractice. Elsevier Science Amsterdam. The Netherlands.
2. Chrispeels, M.J. and SAdava, D.E. (1994). Plants, Genes and Agriculture.Jones & Barlett Publishers.
3. Glick, B.R., Pasternak, J.I. (2003). Molecular Biotechnology-Principles and Applications of recombinant DNA. ASM Press. Washington.
4. Santosh. N., and A. Madhavi. (2010). Practical Book of Biotechnology and Plant Tissue Culture. S. Chand &Co.
5. Slater A., N.W.Scott and M.R. Fowler (2008). Plant Biotechnology. SecondEdition. Oxford.
6. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wileyand Sons, U.K.
7. Steward, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles,Techniques and Applications. John Wiley & Sons Inc. U.S.A.

ENVIRONMENTAL BIOTECHNOLOGY

Objectives:

- To enable the students to understand and how to tackling environmental problems.
- To enable the students to understand the morphological, anatomical and physiological adaptations of hydrophytes, xerophytes and halophytes.
- To develop skills in identification of different forest types of Tamil Nadu.

UNIT – I

Aims and scope of environmental biotechnology. Environmental spheres - Hydrosphere, Geosphere, Biosphere and Anthrosphere. Pollution measurement - Biotechnological methods for measurement of pollution. Role of Biosensors in pollution monitoring.

UNIT – II

Biofuels: Biogas - production of biogas, uses of biogas, Hydrogen production - microbial production of hydrogen, uses of hydrogen Petroleum plants: Calotropisprocera, Euphorbia tirucalli, Jatropha curcas.

UNIT – III

Sewage treatment - Primary, secondary and tertiary treatment, water recycling, soil conservation and restoration. Sustainable agricultural management.

UNIT – IV

Solid waste treatment and disposal, Biodegradation of hydrocarbons, pesticides and herbicides. Bioremediation: Types of Bioremediation, Genetically Engineered microorganisms in Bioremediation. Phytoremediation, Biosensors.

UNIT – V

Greenhouse effect, Global warming, Ozone depletion and Acid rain - Causes, effects and control measures. Remote sensing and its applications in ecology.

PRACTICAL:

Photographs / model: Biogas plant, Biosensor, Sewage treatment, Acid rain, and Greenhouse effect.

Spotters: Petro plants, Calotropis procera, Euphorbia tirucalli and Jatropha curcas

To maintain a record note book for external evaluation.

REFERENCES

1. Mishra. D.D.2008. Fundamental concepts in Environmental Studies. S. Chand and Company Ltd., New Delhi.
2. Saha. T.K. 2008. Ecology and Environmental Biology. Books and Allied (P) Ltd., Kolkatta.
3. Shukla. R.S., and Chandel. P.S. 2007. A text book of plant Ecology,S. Chand and Company Ltd., New Delhi.
4. Singh. H.R. Environmental Biology. S. Chand and Company Ltd, New Delhi.
5. Vijaya Ramesh. K. 2004. Environmental Microbiology, MJP Publishers, Chennai.