

**A.VEERIYA VANDAYAR MEMORIAL SRI PUSHPAM COLLEGE  
(AUTONOMOUS),  
POONDI, THANJAVUR DIST.**

**Question Pattern for UG and PG Programmes for students to  
be admitted during 2014 – 2015 and afterwards**

**Total Marks: 75**

**QUESTIONS PATTERN**

**SECTION – A  
(Question 1 to 10)**

**10 x 2 = 20 Marks**

1. Short Answer Questions
2. Two Questions from each unit (All are answerable)

**SECTION – B  
(Question 11 to 15)**

**5 x 5 = 25 Marks**

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

**SECTION – C  
(Question 16 to 20)**

**3 x 10 = 30 Marks**

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
I	14P1BOC1	<b>Core – I Plant Diversity I (Algae, Fungi, Lichens and Bryophytes)</b>	6	4

### Objectives

#### To enable the students

- ❖ To understand the classification, range of thallus structure, reproduction methods and life cycle patterns of lower plants.
- ❖ To understand the phylogeny and inter relationships of various classes of algae and fungi.
- ❖ To learn various culture techniques for growing freshwater and marine algae in laboratory condition.
- ❖ To know the classification range of structural variations in gametophytes, sporophytes, evolution, ecology and economic importance of Bryophytes.

#### Unit I

Hrs 18

Algae – Classification (Fritsch, Smith and Christensen) – Thallus variations, reproduction, life cycles, phylogeny and inter – relationships of main groups of algae – Ecology and distribution of algae – freshwater, marine, soil and symbiotic algae.

#### Unit II

Hrs 18

Laboratory culture methods – isolation, kinds of culture – culture media for freshwater, (Chu-10 medium and Pringsheim) and marine algae (Guillard F-12 medium) – cultivation methods of micro and macro algae. Pollution – algal bloom and its effect on algal growth – Industrial uses of algae.

#### Unit III

Hrs 18

Fungi – Classification of fungi (Alexopoulos and Mims, 1973) – A systematic study of the mycelial structure and its modification, Nutrition in fungi – Reproduction of fungi – Fruit bodies of fungi – phylogeny and inter relationship of various groups of fungi. Heterothallism – Economic importance of fungi.

#### Unit IV

Hrs 24

Lichen: Classification, Definition, History, Habit and Habitat, Components and their relationships, Types, structure and Reproduction of Lichens – Economic importance and Ecology of Lichens – Some of Indian lichens – fossil lichens.

#### Unit V

Hrs 21

Bryophytes - General characters – Classification (Proskauer, 1957). Structure and reproduction of the main groups of byrophytes. Structural variations in the gametophytes and sporophytes –Ecology of Bryophytes – Economic importance of Bryophytes.

#### Books for Reference

1. Kumar, H.D. and Singh, H.N., (1971). A text book of Algae. East West Press Pvt. Ltd., New Delhi.
2. Bold, H.C. and Wynne, M.J., (1978). Introduction of Algae-structure and reproduction, Prentice Hall, New Jersey.
3. Vasisthta, B.C., Algae.
4. Alexopoulos, C.J.,(1973). Introductory Mycology. Wiley Eastern Private Ltd., New York.
5. Gangulee and Kar, College Botany, Vol. II, New Central Book Agency, Calcutta.
6. Parihar, N.S., (1957). An Introduction to Bryophyta. Central Book Depot, Allahabad.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I</b>	<b>14P1BOC2</b>	<b>Core – II ENVIRONMENTAL BIOTECHNOLOGY</b>	<b>6</b>	<b>4</b>

**Objectives**

- ❖ To enable the students acquire knowledge about their environment.
- ❖ To enable the students identify the environmental problems and issues.
- ❖ To enable the students find out remedial solutions to the environmental problem.
- ❖ To enable the students to acquire knowledge in environment management.

**Unit I**

**Hrs 18**

Environmental degradation– Pollution: Industrial pollution, oil pollution and Biomagnifications. Waste land formation: Abandoned mine lands, ravines, deforestation, shifting cultivation, Impact of Dams, Loss of soil fertility. Global environmental changes. Global warming, Green house effect, Climatic Changes, acid rain and ozone depletion- Population dynamics– Reduction of biodiversity and Web Interaction, Radiation pollution.

**Unit II**

**Hrs 18**

Remote sensing and its applications in resource management and pollution monitoring, Biosensors,-bioremediation–pollution abatement, Application of biotechnology in pulp and paper industry. Biotechnological applications in tannery and distillery. Pesticide waste disposal, Removal of spilled oil by oleophilic microbes. Use of genetically engineered microbes (Super bug) - Bioleaching.

**Unit III**

**Hrs 18**

Aerobic and anaerobic methods of waste water treatment, oxidation. ponds, filters (Trickling and Rotary) –Use of aquatic plant in waste water treatment. Biodegradation of pollutants, Bioenergy from waste, Biomass and biogas production and SCP – Use of sludge and recycling of treated water. Urban waste management.

**Unit IV**

**Hrs 24**

Applications of Biotechnology in forestry, agriculture and wasteland development– Restoration of degraded lands, Reforestation–use of mycorrhizae and microbes in restoration of soil fertility, biofertilizers. Microbial participation in natural cycles of minerals, vermicompost–Biological control of pest population.

**Unit V**

**Hrs 21**

Conservation of resources–Endangered flora and fauna, their identification and documentation–Red Data Book–Conservation strategies, Ex-situ approach, collection, garden seed storage, tissue culture and cryopreservation, gene bank, pollen bank and seed bank. In-situ approach–Biosphere reserves. National parks and sanctuaries– political and legal aspects of biodiversity. The Environmental protection Act–1986. Biodiversity convention-Riode Janeiro-1992, peace friendly concept–Environmental Education.

**Books for Reference**

1. Ignacimuthu, S.J, (1996). Applied Plant Biotechnology. McGraw Hill Publications, Co., Ltd., New Delhi.
2. Kudesia, V.P. and Kudesia, R., (1978). Environmental Health and Technology. McGraw Hill Publications Co., Ltd., New Delhi.
3. Harvinder Sohal and Srivastava, A.K., (1982). Environmental and Biotechnology, Blackwell Publishers, New Delhi.
4. Kumar, H.D., (1982). Modern Concepts of Ecology – Vikas Publishing House Pvt. Ltd.
5. Environmental Chemistry, A.K. De, Wiley Eastern Ltd.
6. Olguin, E.J., Sanchez, G. and Hernandez, E., (2003). Environmental Biotechnology and Clean air Bioprocess. Taylor and Francis.

*M.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching /Weeks	No. of Credits
<b>I</b>	<b>14P1BOC3</b>	<b>Core – III Cytology, Genetics and Plant Breeding</b>	<b>6</b>	<b>4</b>

**Objectives**

**To enable the students**

- ❖ To enable the student to understand the ultrastructure of cell and its components.
- ❖ To get a broad knowledge in the field of genetics.
- ❖ To understand the importance of plant breeding techniques.

**Unit I**

**Hrs 18**

Cytology - Light and sub-microscopic structures of prokaryotic and eukaryotic plant cells. Structure and chemistry of cell wall, cytoplasm, plasma membrane, dictyosomes, endoplasmic reticulum, ribosomes, mitochondria, plastids, vacuoles and inclusions, ergastic substances.

**Unit II**

**Hrs 18**

Detailed study of nucleus, chromosome-types, structure, structural changes and changes in number of chromosomes. DNA as a genetic material - cell cycle. Cell division, Mitosis and Meiosis

**Unit III**

**Hrs 18**

Genetics - Simple interaction – complementary factor-supplementary factor – epistasis – duplicate factor. Multiple factor hypothesis – population genetics.

**Unit IV**

**Hrs 18**

Multiple alleles. Chromosome theory of heredity. Linkage and crossing over-chromosome mapping-sex determination in plants – sex linked inheritance in *Drosophila*. Modern concept of gene and gene expression–cistron, recon and muton (Benzer's experiment).

**Unit V**

**Hrs 18**

Plant Breeding - Principles of plant breeding. Methods of plant breeding, selection (Pure line, mass selection and clonal selection) and domestication. Hybridization in plant breeding. Heterosis and hybrid vigour. Mutation in plant breeding. Polyploidy in plant breeding.

**Books for Reference**

- Gupta, P.K..T. - A text book of Cytology, Genetics & evolution. Rastagi Publications.
- Verma and Agarwal - Cytology
- Sinha & Sinha - Cytogenetics, Plant breeding and evolution Vikas Publishing house.
- Gardener, E.J. - Principles of Genetics.
- Chaudhary - Introduction to Plant Breeding.
- Robert H.Tamarin - Principles of Genetics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	14P1BOEL1A	<b>Major Elective I – BIOFERTILIZER TECHNOLOGY</b>	<b>6</b>	<b>4</b>

**Objectives**

**To enable the students**

- ❖ To understand the important of biofertilizers in agriculture.
- ❖ To know the various types of microbial inoculants used as biofertilizers.
- ❖ To know the methodology of isolation, characterization, identification, mass multiplication and method of applications of biofertilizers.

**Unit I**

**Hrs 18**

General account of the microbes used as biofertilizers for crop plant and their advantages. Symbiotic N<sub>2</sub> fixers: *Rhizobium* – Isolation, Characterization, identification classification, inoculum production and field application – Nitrogen fixation – Nif genes -, Nod gene, Bradyrhizobium and Azorhizobium. Frankia – Isolation, actinorrhizal nodules, non – leguminous crop symbiosis.

**Unit II**

**Hrs 18**

Free living – associative – Non-symbiotic N<sub>2</sub> fixers: *Azotobacter* – isolation characterization, mass inoculums production and field application. *Azospirillum* – Isolation, Characterization, mass inoculums production and filed application.

**Unit III**

**Hrs 18**

Free living nitrogen fixers – Cyanobacteria (BGA), *Azolla* – Isolation, characterization mass multiplication – Role in rice cultivation – crop response – filed application – Immobilization of Cyanobacteria.

**Unit IV**

**Hrs 24**

Phosphate solubilizers; Phosphate Solubilizing Microbes (PSM): *Bacillus megaterium* – Phosphobacteria – Isolation, characteristics – mass inoculum production and mechanism of P-solubilization – field applications.

**Unit V**

**Hrs 21**

Mycorrhizal bioinoculants – Types, classification and their importance – Ectomycorrhizae, Endomycorrhizae, Ectendomycorrhizae - Isolation– Quantification and assessment of VAM from roots – Mass inoculum production and Field applications of Ecto and VAM. Potash mobilizes (*Fraturia aurantia*) – role of bioinputs in organic farming – co-inoculation studies – Microbial consortium – biofertilizer with biocontrol agent – response of biofertilizers in stress – pH and saline.

**Books for Reference**

1. Subbarao, N.S., (1982). Biofertilizers in agriculture and forestry.
2. Bagyaraj, D.J. and Rangaswamy, (2005). Agricultural Microbiology – Tata McGraw Hill., New Delhi.
3. Subbarao, N.S., Soil Microorganisms and Plant Growth.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I</b>	<b>14P1BOEL1B</b>	<b>Major Elective II – BIOFUEL TECHNOLOGY</b>	<b>6</b>	<b>4</b>

### Objectives

- ❖ To have a basic knowledge on Biofuels-origin, structure, occurrence-fossil, fuels-advantages and disadvantages of Bio-fuels.

### Unit I

**Hrs 18**

Introduction-Useful features of biofuels-Undesirable features of biofuels - Energy: Wood, Sugar and Starch Crops, Hydrocarbon Producing crops – utilization of biomass.

### Unit II

**Hrs 18**

The substrate–Industrial and food processing wastes, domestic and municipal wastes. The digester–flow technology digesters, Batch digesters, Continuous flow stirred tank digesters, plug flow type of digesters, upflow anaerobic sludge blanket digesters, film reactors. The microorganisms–Hydrolytic and fermentative bacteria, Syntrophic H<sub>2</sub> producing bacteria, Methanogenic bacteria, Acetogenic bacteria. The process of biogas production-Factors affecting biogas yields - Precautions, Advantages and Disadvantages.

### Unit III

**Hrs 18**

Bioethanol V.S. Petrol-Production of bioethanol-sugar and starch crops, Cellulosic materials. Ethanol recovery-Biobutanol–Microorganism formulations for fermentation medium, process, recovery and uses. - Future directions for research and development for Bio-fuel produce.

### Unit IV

**Hrs 24**

Biodiesel - Plant yielding biodiesel–Pongamia, Jatropha, Castor and Groundnut - Lipids as a source of biodiesel-Biodiesel from hydrocarbons-Advantages and properties of bio-diesel

### Unit V

**Hrs 21**

Biohydrogen - Production-Biocells-biological hydrogen production from bacteria, Algae. Anaerobic bacteria - Photosynthetic algae - *In-vitro* photosynthetic hydrogenase system Advantages of Biohydrogens, Scope for commercial utilization of biohydrogen-Ongoing and future research governing in biohydrogen prediction.

### Books for Reference

1. Bullock, J.D. and Kristiansen, B., (1987). Basic Biotechnology, Academic Press, New York. PP: 9337 – 358.
2. Hobson, P.N. and Whatiey, A.D., (1993). Anaerobic Digestion, Modern Theory and Practice. Elsevier, London.
3. Klasson, K.T., Ackerson, M.D., Clausen, E.C. and Gaddy, J.L., (1992). Bio-conversion synthetic gas into liquid or gaseous fuels. Enzyme Microb. Technol.
4. Leach, C.K. and Van Dam-Mieras, MCE., (1994). Biotechnological Innovations in Energy and Environmental Management Butterworth – Heinemann Ltd., Oxford.
5. Lembi, L.R., Cuashman, J.H., Nichols, R.J. and Wyman, C.E., (1991). Fuel ethanol from cellulosic biomass, Science 251.
6. Meyers, R.A., Molecular Biology and Biotechnology. A comprehensive Desk Reference VCH Publishers, Inc. New York.
7. Woods, D.R., (1993). Clostridia and Biotechnology, Butterwords Oxford.
8. Singh, B.D., (1998). Biotechnology, Kalyani Publishers, Ludhiana, Biofuel – Academic Press.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	14P1BOCP1	<b>Core – PL I - Plant diversity – I, Environmental Biotechnology &amp; Cytology, Genetics and Plant Breeding</b>	6	5

### Objectives

- ❖ To study the vegetative and reproductive structures of important algae, fungi, lichens and bryophytes.
- ❖ To know the equipment used in Microbiology.
- ❖ To study the water pollution, microbes in polluted environment, Microbes in soil fertility, Biocontrol, vermicompost.

### Algae

Study of the vegetative and reproductive structures of the following genera – Hydrodictyon, Scenedesmus, Chaetomorpha, Stigeoclonium, Frittschiella, Bulbochaete, Codium; Acetabularia, Nitella, Botrydium, Diatoms, Turbinaria, Liagora, Gelidiella, Champia, Ceramium, Lyngbya, Stigonema and Nostoc.

### Fungi

Study of the vegetative and reproductive structure of the following genera – *Pythium*, *Albugo*, *Aspergillus*, *Penicillium*, *Taphrina*, *Phyllochora*, *Xylaria*, *Peziza*, *Puccinia*, *Polyporus*, *Lycoperdon*.

### Bryophytes

Study of vegetative and reproductive structures of the following genera: *Marchantia*, *Targionia*, *Reboulia*, *Pallavicinia*, *Porella*, *Anthoceros*, *Polytrichum*.

### Lichens

Study of Vegetative and reproductive structures of *Usnea* species of lichens.

### Environmental Biotechnology

Water Pollution – Effects – demonstration

Sewage water analysis

- Alkalinity
- Free CO<sub>2</sub>
- Chloride
- Dissolved oxygen
- Calcium hardness
- Megneccium hardness

Remote sensing – applications

Microbes of polluted waters

Microbes of oil contaminated soil

Biofertilizer – preparation

Vermicompost – preparation – plant cultivation

### Cytology

Study of cell organelles using slides and electron microphotographs, Mitosis, Meiosis, Karyotype analysis.

### Genetics

Linkage and crossing over

Gene mapping

Sex linked inheritance (from photographs)

### Plant Breeding

Emasculation and Bagging Techniques

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>II</b>	<b>14P2BOC4</b>	<b>Core – I Plant Diversity II (Pteridophytes, Gymnosperms and Paleobotany)</b>	<b>6</b>	<b>4</b>

### Objectives

#### To enable the students:

- ❖ To know classification, salient features of gametophyte and sporophyte, morphology of the major groups, phylogeny, evolutionary status and economic importance of Pteridophytes.
- ❖ To have a comprehensive knowledge on the classification, distribution, general structure, evolutionary significance and economic importance of Gymnosperms.

#### Unit I

**Hrs 18**

Pteridophytes - General characters – Classification, (K.R. Sporne, 1975) – Life cycle patterns – Phylogeny of Pteridophytes – Stelar evolution – Psilophytosida – *Rhynia*, Lycopsida – *Lepidodendron*, *Sigillaria*; Sphenopsida – *Sphenophyllum*, *Calamites*, *Calamostachys*; Pteropsida – *Botryopteris*.

#### Unit II

**Hrs 18**

Study of the vegetative and reproductive structures of the following genera *Angiopteris*, *Ophioglossum*, *Botrychium*, *Osmunda*, *Gleichenia*, *Hymenophyllum*, *Salvinia* and *Azolla* – Soral evolution in ferns – heterospory and seed habit – Telome concept and its significance – Economic importance of Pteridophytes.

#### Unit III

**Hrs 18**

Gymnosperms-General characters–Classification (K.R.Sporne, 1965)–Comparative study of the vegetative and reproductive characteristics of the following orders Pteridospermales (Lyginopteridaceae, Medullosaceae) Bennettiales (Williamsoniaceae) and Pentoxylales (Pentoxylaceae).

#### Unit IV

**Hrs 24**

Evolutionary trends and phylogenetic relationship among various groups of Gymnosperms. Cycadales, Coniferales, Taxales, Ginkgoales and Gnetales – Economic importance of Gymnosperms.

#### Unit V

**Hrs 21**

Paleobotany–Geological time scale–Types of fossils and methods of Fossilization – Fossil distribution in India. Radio carbon dating–importance of the study of Paleobotany.

### Books for Reference

1. Sporne, K.R. and Hutchinson Co.,(1970). The Morphology of Pteridophytes, London.
- 2.Rasheed, (1976). Pteridophyta, Vikas Publications, New Delhi.
- 3.Sporne, K.R. and Hutchinson Co., (1970). The Morphology of Gymnosperms, London.
- 4.Vasishta,P.C. and Ghand, S., (1996). Gymnosperms, Ghand and Company Ltd., New Delhi.
- 5.Arnold, C.I.A., (1947). An introduction to Paleobotany –McGraw-Hill, New York and London.
- 6.Parihar, N.S., (1967). The Biology and Morphology of Pteridophytes by New Central Book, Depot Allahabad.
- 7.Living Cycads by Chamberlain.
- 8.College Botany Vol. II by Gangulee and Kar, New Central Agecny, Calcutta.
- 9.Gnetales by Pearson.
- 10.Gnetales by Maheswari and Vasil
- 11.Gymnosperms by Chamberian.



Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	14P2BOC5	<b>Core – II Angiosperms Anatomy, Embryology and Microtechnique</b>	6	5

**Objectives**

- ❖ To study tissues, their classification and functions.
- ❖ To study meristems, their classification and distribution.
- ❖ To study the various aspects of roots and stems of dicots and monocots.
- ❖ To study the microsporogenesis and megasporogenesis
- ❖ To study the structure and development of endosperm and embryo
- ❖ To learn various methods of microtechniques

**Unit I**

**Hrs 18**

Anatomy - Development of seed plant – apical meristem and their derivatives. Xylem – development of primary xylem – differentiation of tracheary elements – gross structure of secondary xylem – cell types – phylogenetic specialization. Variation in wood structure – conifer and dicotyledon woods – factors involved in the development of secondary xylem – identification of wood. Vascular cambium - Phloem – cell types; differentiation of sieve elements- primary phloem and secondary phloem – conifer and dicotyledonous phloem.

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**Unit II**

**Hrs 18**

Root – development – apical meristem – lateral root, adventitious roots. Stem – vascular system – shoot apex origin of leaves and branches – primary phylogenetic and evolutionary considerations – Floral vasculature. Seedling anatomy – Root-stem transition.

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**Unit III**

**Hrs 18**

Embryology of Angiosperms - Structure and development of microsporangium – microsporogenesis – ultra structure of microspore and microspore wall – pollen viability test – morphology, cytology and physiology of anther tapetum – pollen embryosaac – megasporangium – megasporogenesis – types of embryosaac – sexual incompatibility.

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**Unit IV**

**Hrs 24**

Fertilization and its significance – Endosperm types, haustoria – Ruminant endosperm – classification of embryo based on development in dicot plants – Monocot embryo development – suspensor – Apomixis – polyembryony – structure and development of seed coat.

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**Unit V**

**Hrs 21**

Microtechnique: Killing and fixation- Dehydration – clearing, infiltration, embedding, block making – sectioning – Microtomes – types; stains and staining, smear and squashes.

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**Books for Reference**

1. Faun, A., (1967). *Plant Anatomy*, 2<sup>nd</sup> Ed., Wiley, New York.
2. Easu, K., (1965). *Plant Anatomy*, 2<sup>nd</sup> Ed., Wiley, New York.
3. Easu, K., *Anatomy of Seed Plants*.
4. Cutter, E.G., (1965). *Plant Anatomy Experiment and Interpretation Part I Cells and tissues*, Edward Arnold London.
5. Cutter, E.G., (1971). *Plant Anatomy Experiment and Interpretation Part II Organs*, Edward. Arnold London.
6. Bhojawani and Bhatnagar, (1990). *Embryology of Angiosperms*, VikasPublishing House (P) Ltd., New Delhi.
7. Swamy, B.G.L. and Krishnamoorthy, M.V., (1980). *From Flower to Fruit*, Tata McGraw Hill Publishing Co., New Delhi.
8. Wardlaw, C.W., (1976). *Embryogenesis in Plants*, Methers and Co. London.
9. Raghavan, V., (1976). *Experimental Embryogenesis in Vascular Plants* Academic Press, London.
10. Johri, P.M., (1986). *Embryology of Angiosperms*.
11. Prasad, M.K. and Krishna Prasad, M., (1975). *Outlines of Microtechnique*, Emky Publications, Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>II</b>	<b>14P2BOC6</b>	<b>Core III – Molecular Biology and Genetic Engineering</b>	<b>6</b>	<b>4</b>

**Objectives**

**To enable the students:**

- ❖ To know the structure of nucleic Acids.
- ❖ To understand the mechanism of DNA replication
- ❖ To understand the molecular mechanism of protein synthesis and gene expression
- ❖ To understand the application of Recombinant DNA Technology

**Unit I**

**Hrs 18**

Structure of nucleic acids – DNA – double helix – Types of DNA – super coiling – Types of RNA – mRNA, rRNA and tRNA. Sub – unit structure of ribosomes in prokaryotes and eukaryotes.

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**Unit II**

**Hrs 18**

Eukaryotic genome organization. Structure of chromatin, coding and non-coding sequences. DNA – Semi conservative replication – Enzymes involved in DNA replication – helicases, topoisomerases, DNA polymerases, DNA ligase, nucleases, methylases.

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**Unit III**

**Hrs 18**

Transcription – Mechanism of transcription in prokaryotes and eukaryotes. RNA processing – capping, polyadenylation and splicing. Translation – Genetic code – Protein synthesis.

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**Unit IV**

**Hrs 24**

Regulation of Gene expression – operon concept, Lac operon and trp operon. DNA methylation – Eukaryotic gene regulation (Britten and Davidson model) Heterochromatization.

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**Unit V**

**Hrs 21**

Tools and techniques of Recombinant DNA technology - Vectors – plasmids and their types – cosmids, phagemids – Southern, northern and western blotting techniques – PCR and its application – Construction and screening of Genomic libraries and cDNA libraries.

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**Books for Reference**

1. Friefelder, D., (1987). Molecular Biology, 2<sup>nd</sup> Ed., Jones and Barlett Publishers, Boston.
2. Grierson, D.S. and Covey, S.N., (1988). Molecular Biology 2<sup>nd</sup> Ed., Blackie, Chapman and Hall, New York, USA.
3. Malchensky and Frifelder, (2003). Molecular Biology. Narosa Publishing House, New Delhi.
4. Gupta, P.K., (2002). Cell and Molecular Biology Rastogi Publications, Sivaji Road, Meerut.

*M.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>II</b>	<b>14P2BOEL2A</b>	<b>Major Elective I - Horticulture</b>	<b>6</b>	<b>4</b>

**Objectives**

- ❖ To understand the main principles and importance of horticulture
- ❖ To develop skill in horticultural techniques
- ❖ To know the various methods of plant propagation
- ❖ To develop potential for self employment.

**Unit I**

**Hrs 18**

Importance and scope of horticulture – Divisions of horticulture – climate, soil and nutritional needs – water irrigation – plant propagation method – cutting, layering, grafting, budding, stock-scion relationship. Glass houses.

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**Unit II**

**Hrs 18**

Fruit crops – Induction of flowering, flower thinning, fruit setting, fruit development – cultivation of important fruit crops – Mango, lime and Guava – Vegetable crops: classification of vegetables, cultivation of important vegetable crops – Tomato, Brinjal and Garden bean (*Dolichos lablab*).

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**Unit III**

**Hrs 18**

Principles and methods of designing a flower (out door) garden hedges, sedges, fences, trees, climbers – Rockeries, Arches, terrace garden Lawn making and maintenance, water garden – cultivation of water plants and common water plants.

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**Unit IV**

**Hrs 24**

Indoor gardening – House plant, light, humidity, watering, designing - Bonsai plants – watering, pruning, dwarfing - Flower decoration – Wet decoration – cultivation of commercial flower crops – Rose, Jasmine, Chrysanthemum.

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**Unit V**

**Hrs 21**

Storage of fruits and vegetables – Preservation of fruits and vegetables - Nursery – Micropropagation – Hardening and transplantation – Germ plasm maintenance of sweet potato and cassava.

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**Book for Reference:**

1. Text Book of Horticulture – K.Manibushan Rao (1991) McMillan.
2. Introduction to Horticulture – N.Kumar (1986) Rajalakshmi Publishers.
3. A Guide on Horticulture–J.S.Sundararaj, S.Muthusamy, Dr.K.G.Shanmugavelu, R.Balakrishnan.
4. Horticulture – Principles and Practices George Acquaah. (2004) 3<sup>rd</sup> Ed. Culinary and Hospitality Industry Publication Service.
5. D.H.Franker and J.G.Hawkes, Crop genetic resources for today and tomorrow Cambridge University, Press London.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>II</b>	<b>14P2BOEL2B</b>	<b>Major Elective II – FOOD PRESERVATION AND PROCESSING</b>	<b>6</b>	<b>4</b>

**Objectives**

- ❖ To understand the various processes involved in food preservation and processing.
- ❖ To develop skill in preparing preserved foods.

**Unit I**

**Hrs 18**

Food Preservation: Kinds of foods – on the basis of source: Plant and animal source; on the basis of ease of spoilage perishable, semiperishable, non-perishable. Foods preservation principles and methods. Types of preservation – Temporary preservation – asepsis, low temperature, antiseptics, pasteurization, exclusion of air, electromagnetic radiation – Permanent preservation. Sterilization processing by heat, effect of acidification, antiseptics, drying, fermentation, exclusion of air.

**Unit II**

**Hrs 18**

Chemical methods of Preservation: Preservation by salting, Preservation by sugar syrup for canning jam: Role of pectin in Jam preparation. Jelly – constituents of jelly, fruit jelly, preparation of jelly Preservation by Chemicals: benzoic acid, parafin, sulphur-di-oxide, sulphites, nitrites, diethylpyrocarbonates (DEPC), Hydrogen Peroxide Chlorine, CO<sub>2</sub>, Preservation by antibiotics and irradiation. Preservation by cold storage, Preservation by sugars.

**Unit III**

**Hrs 18**

Food additives: Definition – preservatives – anti-oxidants – colouring agents, emulsifier, establishers and thickness, bleaching and maturing agents, clarifying agents, antifforming agents, nutrient supplements, non-nutritive sweetness; functions of additives. Food adulteration – adulterants and simple detection techniques – food grades – standards, laws and regulations.

**Unit IV**

**Hrs 24**

Processing–Methods–open cookers, continuous non-agitating cookers, continuous agitating cookers. Processing of fruits and fruit products–Canning of fruits, Preparation of fruit juices – squashes–cordials–Extraction equipment–continuous screw expeller press, filtration equipment–deaerator, flash pasteurizer, uses of thinning agents, clarification.

**Unit V**

**Hrs 21**

Vegetable and vegetable products: Canning of vegetable, pickles, chutneys, etc., Baked Products: Classification of wheats – hard wheat, soft wheat, durum wheat, flour preparation baking formulation, processing. Milk and milk products: Composition of milk, milk products butter, ghee, lassi, unfermented milk products, condensed milks, cheese, ice cream and milk powder.

**Books for Reference:**

1. Manorajan Kaila and Sangita, Food Preservation and processing, Department of Food Science and nutrition, College of Home Science. Himachal Pradesh, Agri University, Palampur (H.P.) 176 062.
2. Giridharilal, Siddappa, G.S. and Toandon, G.L. Preservation of Fruits and Vegetables – CFTRI, Mysore.
3. S.Ranganna – Hand book of analysis and quality control for fruit, vegetables products – CFTRI, Mysore.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
II	14P2BOCP2	<b>Core – PL II – Plant Diversity II, Plant Anatomy, Embryology, Microtechnique, Molecular Biology and Genetic Engineering</b>	6	4

### Objectives

#### To enable the students:

- ❖ To study the vegetative and reproductive structures of Pteridophytes and Gymnosperms.
- ❖ To study the structure of meristems, xylem, phloem, cambium and Nodal anatomy and stomata
- ❖ To study the different methods employed in molecular biology and genetic engineering

### Pteridophytes

Study of the vegetative and reproductive structure of the following genera: *Rhynia*, *Lepidodendron*, *Calamites*, *Adiantum*, *Ophioglossum*, *Botrychium*, *Osmunda*, *Gleichenia*, *Salvinia*, *Azolla*.

### Gymnosperms

Study of the vegetative and reproductive structures of the following genera: *Lyginopteris*, *Heterangium*, *Medullosa*, *Pinus*, *Podocarpus*, *Araucaria*, *Cupressus*, *Gnetum*.

### Molecular Biology and Genetic Engineering

Isolation and Estimation of Genomic DNA  
Construction of Standard graphs for DNA and RNA  
Semi-conservative replication (Chart)  
Lac operon and tryptophan operon model (diagram)  
Lytic cascade and lysogenic repression (diagram)  
Southern blotting technique and Hybridization (diagram)  
Polymerase Chain Reaction – Procedure  
C DNA synthesis - Diagram

### Anatomy

Study of different types of apical meristems (Shoot and Root) – Study of different types of xylem elements by maceration methods, measurement.

### Wood

T.S, R.L.S and T.L.S of *Pinus* wood  
T.S, R.L.S and T.L.S of Dicot wood

### Vascular Cambium

Cambial zone in T.S. and L.S, storied and non storied cambium.

### Phloem

Study of structure and distribution of sieve elements in *Pinus*, *Cucurbita* and *Tinospora* stems. Nodal structures – Unilacunar, Trilacunar and Multilacunar. Stomatal types – Frequency and stomatal index.

### Embryology

Study of different types of anther – Embryo and Endosperm mounting.

### Microtechnique

Preparation of permanent and semipermanent slides.

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Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III</b>	<b>14P3BOC7</b>	<b>Core I – Plant Taxonomy and Economic Botany</b>	<b>6</b>	<b>5</b>

**Objectives**

- ❖ To enable the students to get a fair knowledge of taxonomy of angiosperms.
- ❖ To enable the students to know the modern trends in taxonomy of angiosperms.
- ❖ To enable the students to develop skill in identifying the angiosperms upto species level.

**Unit I**

**Hrs 18**

System of Classification: Artificial Systems - John Ray, Linnaeus; Natural Systems - De Jussieu de Candolle, Bentham & Hooker; Phylogenetic Systems - Engler and Prantl, Hutchinson, Takhtajan.

**Unit II**

**Hrs 18**

ICBN - Types and Typification - Principles of priority and their limitations - Effective and valid publications - Citations - Retention, Choice and rejection of names - Problems in nomenclature, Herbarium and its potential role in teaching and research. Preparation of keys - (Types), Flora - Monographs - Botanical gardens.

**Unit III**

**Hrs 18**

Biochemical taxonomy - micromolecules (Primary and Secondary Metabolites) and macromolecules (Proteins, Nucleic acids, Polysaccharides), Numerical Taxonomy - Biosystematics - Anatomy, Embryology, Palynology, Ecology, Cytology and Serology in relation to Taxonomy (each 3 examples) - Molecular Taxonomy; RFLP.

**Unit IV**

**Hrs 24**

Study of the following families: Menispermaceae, Polygalaceae, Caryophyllaceae, Rhamnaceae, Vitaceae, Combretaceae, Onagraceae, Aizoaceae, Apiaceae, Gentianaceae, Boraginaceae, Verbenaceae, Nyctaginaceae, Loranthaceae, Aristolochiaceae, Liliaceae, Amaryllidaceae, Commelinaceae, Typhaceae, Cyperaceae.

**Unit V**

**Hrs 21**

Economic Botany - Fibre types; Fibre yielding plants; Timber; Principal Woods of India, Medicinal plants: Drugs obtained from roots, underground stems, barks, stems, woods, leaves, flowers and fruits, all parts of plants - Spices and condiments ; Spices obtained from roots, underground stems, barks, flower buds and flowers, fruits, seeds and leaves - Fatty oils: Drying and semidrying oils, non-drying oils, vegetables fats - Essential Oils: types, oil yielding plants.

**Books for Reference**

1. Ramasamy, S.N., Lakshminarayana and Venkateswaralu, V., Taxonomy of systematic Botany.
2. Gangulee Das and Kar College Botany, Vol. II, New Central Book Depot, Calcutta.
3. George, H.M. Lawrence (1967) Ed. Taxonomy of Vascular plants, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III</b>	<b>14P3BOC8</b>	<b>Core II - Microbiology and Plant Pathology</b>	<b>6</b>	<b>4</b>

### Objectives

- ❖ To understand classification of microbes, structure and reproduction.
- ❖ To gain some basis knowledge in soil & Industrial Microbiology
- ❖ To gain knowledge on mycoses & Antibiotics
- ❖ To know the basis of plant pathology, crop disease and their control

### Unit I

**Hrs 18**

Classification of microorganisms (Bacteria – Bergey’s Manual 9<sup>th</sup> Ed.) Fungi, Viruses, Algae and Protozoa. Bacteriology: Morphology, structure, nutrition, reproduction – growth (Growth curve and physical conditions required for growth). Virology: Morphology of viruses (Size, shape and structure) – replication of viruses – transmission of viruses – isolation and purification of viruses. General account of mycoplasmas.

### Unit II

**Hrs 18**

Soil Microbiology - Common soil microflora – influence of environmental factors – moisture, light, wind, pH, temperature and organic matter. Plant Surface Microbiology: Definitions and explanations of the following: Rhizosphere, Rhizoplane, Phylloplane and Spermosphere. Industrial Microbiology: Microbiology of sewage, waste water treatment – general design and applications of a biofermenter, industrial fermentation (alcohol).

### Unit III

**Hrs 18**

Medical Microbiology: Systemic mycoses - Dermatophytes – Therapeutic drugs for treatment of fungal diseases. Antibiotics: Structure and mode to action with reference of Penicillin & Streptomycin.

### Unit IV

**Hrs 24**

Plant Pathology: History–present status – Koch’s postulates. Primary and Secondary sources of inoculums. Symptoms of plant diseases – classification of plant diseases. Dissemination of plant pathogens – Disease resistance - Plant Protection.

### Unit V

**Hrs 21**

Diseases caused by fungi (Blast of paddy, Red rot of sugarcane) by bacteria (Blight of Paddy, Black arm of cotton), by virus (Bunchy top of Banana and TMV), by Mycoplasma, (Citrus stubborn, Corn stunt) - Control of plant diseases– cultural, physical, chemical and biological methods.

### Books for Reference

1. Schlegel, H.S., (1986). General Microbiology 6<sup>th</sup> Ed. (Translated by M.Kugut) Cambridge University Press, London.
2. Pelczar, Reid & Chan, (1986). Microbiology Tata Mac. Hill, New Delhi.
3. Cassida, Industrial Microbiology.
4. Walker, J.C., (1953). Plant Pathology.
5. Agriose, G.W., (1970). Plant Pathology.
6. Johnston, A. and Booth, C., (1983). Plant Pathologists “Pocket book” 2<sup>nd</sup> Ed. Common Wealth Mycological Institute London.
7. Rengaswami, G., Diseases of crop Plants in India.
8. Mehrotra, R.S., (1980). Plant Pathology, Tata MC Graw Hill Publishing Company Limited, New Delhi.



Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III</b>	<b>14P3BOC9</b>	<b>Core III - Plant Biotechnology</b>	<b>6</b>	<b>5</b>

**Objectives**

- ❖ To know the principles and applications in various fields of biotechnology.
- ❖ To enable the student to understand the different technologies involved in tissue culture.
- ❖ To apply the knowledge of tissue culture in the commercial and industrial field of agriculture.

**Unit I****Hrs 18**

Scope and history of plant tissue culture; culture technique – tissue culture media white, MS and B5 media, media preparation, sterilization - explant preparation and inoculation, callus induction, organogenesis, Meristem culture, Micropropagation.

**Unit II****Hrs 18**

Suspension culture, somatic embryogenesis, Artificial seed; Anther and ovule culture, haploids in crop improvement; Protoplast isolation, fusion, somatic hybridization.

**Unit III****Hrs 18**

Transformation – Gene transfer techniques – Gene construction, Control of expression – promoters and Tissue specific regulatory sequences (enhancer/silencer) – Rubisco, chlorophyll a/b binding protein, heat shock protein, alcohol dehydrogenase (ADH). Marker genes – GUS, Luciferase & Nopaline (nos).

**Unit IV****Hrs 24**

Agrobacterium mediated gene transfer – Ti plasmid characteristic features, disarming, reconstruction of Ti plasmid, co-integrative and Binary vector; Molecular biology of infection, Co-cultivation, integration of T-DNA into host genome – viruses as vectors; Direct gene transfer – Electroporation, Micro injection, Biolistic missiles, Ca<sup>++</sup> ion under high pH.

**Unit V****Hrs 21**

Plant biotechnology in agriculture and industry. Transgenic plants for virus resistance, herbicide tolerance, Molecular pharming, Production of secondary metabolites in culture. Antisense RNA technology – slow ripening of tomato.

**Books for Reference**

1. Bhojwane, S.S. and Razdan, M.K., Plant Tissue Culture: Theory and practice, Elsevier Science.
2. Gupta, P.K., Biotechnology – Rastogi Publications, Meerut.
3. Singh, B.D., (1988). Biotechnology – Kalyani Publishers, Ludhiana.
4. Plant Secondary metabolite K.G.Ramawat (S.Chand).

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III</b>	<b>14P3BOCP3</b>	<b>Core – PL III - Plant Taxonomy, Economic Botany, Microbiology, Plant Pathology and Plant Biotechnology</b>	<b>6</b>	<b>5</b>

### **Objectives**

- ❖ To identify the families of plants in the theory syllabus.
- ❖ To prepare dichotomous keys.
- ❖ To identify economically important plants & products
- ❖ To know about the various techniques involved in microbiology and biotechnology
- ❖ To gain knowledge on the diseases of crop plants

### **Plant Taxonomy and Economic Botany**

- Identification of the families and binomial of the plants belonging to the families mentioned in the theory syllabus.
- Preparation of dichotomous keys (indented)
- Problems in nomenclature
- Identification of economically important plants and plant products mentioned in the theory syllabus.

### **Biotechnology (Demonstration / Charts / Photographs)**

- Media Preparation
- Callus induction
- Protoplast Isolation
- Meristem culture

### **Microbiology**

Uses of equipments in Microbiology – Hot air oven, Autoclave, Inoculation needle, filters, Laminar flow.

- Isolation of microbes from soil
- Gram staining of bacteria
- Effect of different antibiotics of bacterial growth
- Effect of pH on Bacterial growth / fungal growth
- Microbial analysis of milk by Methylene blue reduction test
- Isolation of Rhizobium from root nodules / stem nodules
- Isolation of VAM spores from soil
- Assessment of VAM in roots.

### **Plant Pathology**

- Study of herbarium or Fresh specimens of Blight of Paddy, Black Arm of Cotton, TMV, Bunchy Top of Banana, Little Leaf of Brinjal, White Rust, Tar Spot, Rust and Smut on wheat, Brown Spot of Rice, Tikka Diseases of Groundnut.
- Baiting Technique – using sunflower seeds
- Demonstration of cell wall degrading enzyme activity by Rhizopus / Fusarium on Potato tuber discs.

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Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>IV</b>	<b>14P4BOC10</b>	<b>Core I – Research Methodology</b>	<b>6</b>	<b>5</b>

**Objectives**

- ❖ To make the students to learn the physiological techniques.
- ❖ To make the students understand the main principles in biostatistics
- ❖ To make the students apply statistical principles in biological studies
- ❖ To enable the students to understand computer hardware, software and various programming languages
- ❖ To make the students know the scientific application of packages
- ❖ To make the students to understand the problem selection and project design
- ❖ To make the students to understand the basics of research and report preparation

**Unit I**

**Hrs 18**

Research design – Choosing the problem for research – Review of literature – Primary, Secondary and Tertiary sources. Bibliography indexing and abstracting – Reporting the results of research in conference – Oral presentation – Poster Presentation – Planning and Preparing a thesis – Proof correction.

**Unit II**

**Hrs 18**

Principles and applications of Bright field, dark field, phase contrast, fluorescence, polarization, scanning and transmission electron microscopy – Fixation and staining of materials for Electron microscope. Basic knowledge in Nano technology.

**Unit III**

**Hrs 18**

Principles, Instruments and applications: pH meter – Centrifuge – Rotors – Ultra centrifuge – Radio active isotopes and half life of isotopes – Autoradiography – Scintillation counter, GM counter – Chromatography - types – affinity and HPLC – Colorimeter, UV. vis Spectrophotometer – Flame Photometer – Atomic absorption Spectrophotometer – Electrophoresis - vertical and horizontal types, SDS PAGE.

**Unit IV**

**Hrs 24**

Scope of biostatistics – Graphical and diagrammatic representation – Mean, Median, Mode – Standard deviation – Standard error – Test of significance 't' test, one-way ANOVA – Simple correlation and Simple linear regression.

**Unit V**

**Hrs 21**

Basic knowledge of computers and Bioinformatics – Organization of a computer (CPU, input devices, output devices and Memory) – Internet Basic (Internet Browsing) – websites and web pages – Links. Website addresses – Information in the web – Internet file types – saving internet text. E.mail, Attaching files – searching the net. Data Bases: Nucleic acid sequence databases (EMBL, Gen Bank, DDBJ) and Protein sequence Data bases (PIR, SWISS-PROT, PDB).

**Books for Reference**

1. Jayaraman, J., (1972). Techniques in Biology, Higginbothams, Pvt. Ltd., Madras.
2. Jayaraman, J., (1985). Laboratory Manual in Biochemistry, Wiley Eastern Ltd., New Delhi.
3. Connor & Peter Woodford, (1979). Writing Scientific Paper in English Pitman, Medical Pub. Co., Ltd., England.
4. Balagurusamy, E., (1985). Programming in BASIC, 2<sup>nd</sup> Ed., Tata McGraw Hill Pub. Co., New Delhi.
5. Dheenadayalu, R., (1987). Computer Science, Vol-I Tata McGraw Hill Pub. Co., Ltd., New Delhi.
6. Khan, I.A., and Khanum, A., (1994). Fundamentals of Biostatistics, Vikas Pub., Hyderabad.
7. Kothari, C.R., (1991). Research Methodology – Methods and Techniques, Wiley Eastern Ltd., New Delhi.
8. Sree Ramulu, V.S., (1988). Thesis Writing, Oxford & IBH Pub., New Delhi.
9. Zar, J.H., (1984). Biostatistics Analysis, Prentice Hall International, England Cliffs, New Jersey.
10. Attwood Teresa, K., Parry, Smith and David, J., (2001). Introduction to Bioinformatics cell and molecular Biology in Action series Pearson Education (Asia) New Delhi.
11. Rastogi, S., Mendinatta, N. and Rastogi, P., (2003). Bioinformatics concepts skills and applications CBS. Publishers, New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>IV</b>	<b>14P4BOC11</b>	<b>Core – II Plant Physiology, Biochemistry and Biophysics</b>	<b>6</b>	<b>5</b>

**Objectives**

**To enable the students:**

- ❖ To understand the metabolic activities of plants.
- ❖ To understand the role of enzymes in various metabolic activities of plants.
- ❖ To understand the energy relationships in various metabolic activities.
- ❖ To understand the molecular physiology and development of plant growth

**Unit I**

**Hrs 18**

Biophysics: Thermodynamics–Redox reaction–Energy coupling reactions – Energy rich compounds–ATP, NADPH<sub>2</sub>, FADH<sub>2</sub>, ATP cycle. Biological energy transducers, Energy states of electron spin–ground and excited states, Fluorescence, Phosphorescence, Absorption and action spectrum, Mitochondrial and chloroplast Bioenergetics – Transport across the membrane.

**Unit II**

**Hrs 18**

Enzymes: Classification and Nomenclature– Isolation and purification – Properties – Mechanism of enzyme action – Michaelis Menton equation and Km value. Apoenzymes, co-enzymes and Isoenzymes. Activation and induction, Inhibition and repression. Factors affecting enzyme action.

**Unit III**

**Hrs 18**

Metabolic Pathways: Photochemical phase–Photosystem I and II and their components–Emerson effect–Electron transport in PS I and PS II. Photolysis of water, Photo-phosphorylation. Carbon fixation: C<sub>3</sub>, C<sub>4</sub> and CAM pathways, Kranz anatomy and its types, Photorespiration and its significance. Carbohydrates–Monosaccharides and polysaccharides.

**Unit IV**

**Hrs 24**

Respiration: Glycolysis, TCA cycle, Pentose phosphate pathway and terminal oxidation–Anaerobic respiration and fermentation. Lipid Metabolism. β-oxidation. Fate of acetyl–COA Glyoxylate cycle. Fat synthesis (Syntheses of fatty acids, synthesis of glycerol. Condensation of fatty acids and glycerol. Phospholipids). Nitrogen metabolism: Biological nitrogen fixation, Nitrate reduction, Reductive and oxidative animation–Transamination synthesis of amino acids, role of amides, Proteins–structure and properties.

**Unit V**

**Hrs 21**

Growth physiology and Photomorphogenesis: Auxin-bioassay, chemical nature, biosynthesis and mode of action, physiological effects – Gibberellins – Chemical nature, Mode of action and physiological effect – ABA and Ethylene, A general account of morphactins, vitamins and polyamines. Photomorphogenesis: Regulating aspects. Phytochrome: Structure and function, phytochrome controlled photoregulation and flower induction: Photoperiodism and vernalization.

**Books for Reference**

1. Lehninger, (1982). Principles of Biochemistry–C.B.S. Pub and distributors, New Delhi.
2. Bidwell, R.G.S., (1979). 2<sup>nd</sup> Ed., Plant Physiology, Mcmillan Pub. Co., Inc. New York.
3. Devlin, R.M. and Witham, F.H., (1982). 4<sup>th</sup> Ed., Plant Physiology C.B.S. Pub. and distributors New Delhi, 32.
4. Goodwin, F.W. and Mercer, F.I., (1983). 2<sup>nd</sup> Ed., Introduction to plant biochemistry, Pergamon Press, New York.
5. Noggle, R. and Fritz, G.J., (1989). 2<sup>nd</sup> Introduction of Plant Physiology Prentice Hall of Indian Pub., Ltd., New Delhi.
6. Salisbury, F.B. and Ross, (1974). Plant Physiology – Prentice hall, India Ltd.,

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>IV</b>	<b>14P4BOEL3A</b>	<b>Major Elective I – APPLIED PHYCOLOGY</b>	<b>6</b>	<b>4</b>

**Objectives**

- ❖ To understand the applied aspects of algae and their mass cultivation

**Unit I**

**Hrs 18**

Historical perspectives- use of algae for human needs – Algae as a source of food and feed – as biofertilizers – Single cell protein – Industrial uses of algae.

**Unit II**

**Hrs 18**

Mass cultivation of commercially valuable marine macro algae – the extraction of agar-agar, carrageenan, alginates and other minerals. Media for the culture of micro algae (ASN<sub>3</sub>, BG11) and macro algae (Guillard, F/2).

**Unit III**

**Hrs 18**

Positive and negative role of algae in agriculture and fisheries – algae in closed system: Symbiotic algae – Algae in medicine, Parasitic algae - Phycopathology.

**Unit IV**

**Hrs 24**

Role of algae in environmental health: Sewage treatment: Industrial effluents, soil reclamation. Aquatic pollution; causes and consequence; algae as indicators in assessing water quality and pollution; Saprobien index.

**Unit V**

**Hrs 21**

Problems of eutrophication: algal blooms -toxic algae – control of nuisance algae – Algal cultures and their utility: Source of algal cultures: algal culture collection centres of the world – Genetic modification of algae.

**Books for Reference**

1. Bold & Wynne, M.J., (1978). Introduction of Algae.
2. Carr & Whitton, B.A., (1981). The Biology of Cyanobacteria, Black Well, Oxford.
3. Chapman, V.J., (1962). The Algae, Macmillan Company Ltd., St. Martin Press, New York.
4. Venkataraman, G.S., (1969). The Cultivation of Algae, I.C.A.R. New Delhi.
5. Chapman, V.J. and Chapman, D.J., Seaweeds and their uses, Chapman and Hall, London.
6. Fay, Blue greens
7. Venkataraman, G.S., Algae - form and function
8. Kumar, H.D., (1990). Introductory Phycology, Affiliated East, West Press Pvt. Ltd., New Delhi.
9. Loban, C.S. and Wynne, M.J., Biology of seaweeds. Roud, F.F., Ecology of Algae.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>IV</b>	<b>14P4BOEL3B</b>	<b>Major Elective II – MUSHROOM CULTIVATION</b>	<b>6</b>	<b>4</b>

**Objectives**

**To enable the students**

- ❖ To know the various types of edible mushroom and their nutritional value.
- ❖ To understand the methods of cultivation of mushrooms.
- ❖ To know the types of food prepared from mushroom and their importance in human health.
- ❖ Marketing of mushrooms in India and abroad

**Unit I**

**Hrs 18**

Introduction – history – scope of edible mushroom cultivation – Types of edible mushroom available in India – *Calocybe indica*, *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.

**Unit II**

**Hrs 18**

Pure culture – preparation of medium (PAD and Oatmeal Agar medium) sterilization – preparation of test slants to store mother culture – culturing of *Pleurotus* mycelium on petriplates, preparation of mother spawn in saline bottle and polypropylene bag and their multiplication.

**Unit III**

**Hrs 18**

Cultivation Technology: Infra structure: substrates (locally available) Polythene bag, vessels, Inoculation hood, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag, Mushroom bed preparation – Paddy straw, sugarcane thrash, maize straw, banana leaves. Factors affecting the mushroom bed preparation low cost technology, composting technology in Mushroom production.

**Unit IV**

**Hrs 24**

Storage and nutrition: Short-term storages (Refrigeration – upto 24 hrs) Long term storage (canning, pickles, papads), drying, storage in salt solutions, Nutritive Value – proteins – amino acids, mineral elements nutrition – carbohydrates, Crude Fibre content - vitamins.

**Unit V**

**Hrs 21**

**Food Preparation:**

- Types of foods prepared from mushroom; soup, cutlet, omelette, samosa, pickles, curry.
- Research Centres – National level and Regional level
- Cost benefit ratio – Marketing in India and abroad, Export value.

**Books for Reference:**

1. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan, R., (1991). *Oyster Mushrooms*, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M., (1990). Food and Nutrition, Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore 560 018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom Cultivation, Mittal Publications Delhi.
4. Nita Bahl (1984 – 1988). Hand Book of Mushrooms, II Ed., Vol. I & Vol. II.

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Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>IV</b>	<b>14P4BOCP4</b>	<b>Core – PL IV – Research Methodology and Plant Physiology</b>	<b>6</b>	<b>5</b>

**Objectives**

- ❖ To know the various aspects pertaining to research
- ❖ To identify the instruments, their parts and applications
- ❖ To prepare buffers, standard graphs etc
- ❖ To estimate various physiological parameters in plants
- ❖ To know about the enzymes and their role in plant physiology
- ❖ To gain practical knowledge on the application of computer in research

**Research Methodology**

**Hrs 18**

1. Preparation of Index cards.
2. Preparation of bibliography
3. Proof correction
4. Preparation of standard graph for sugars
5. Preparation of standard graph for amino acids
6. Preparation of standard graph for proteins
7. Identification of instruments / their parts and applications
8. Preparation of computer graphs and diagram using MS Excel of usage of power point
9. Biostatistics problems.

**Plant Physiology Practical**

**Hrs 60**

1. Preparation of Buffers.
2. Study of Hill reaction with isolated chloroplasts
3. Separation of amino acids by paper chromatography
4. Separation of pigments by paper chromatography
5. Separation of pigments by thin layer chromatography
6. Estimation of soluble sugars
7. Estimation of protein
8. Estimation of amino acids
9. Estimation of starch
10. Determination of saponification value of fatty acids
11. Estimation of xanthophylls and carotene from the given material
12. Finding out the absorption spectrum of chlorophyll from the given material
13. Assay of nitrate reductase activity
14. Assay of Catalase activity