

A.V.V.M. SRI PUSHPAM COLLEGE (AUTONOMOUS), POONDI

Programme: M. Sc.

Department: Botany

Syllabus Revision 2017-2018

S.No.	Courses	Number of courses having changes
1.	Core Course	12
2.	Elective Course	03
	TOTAL	15

Total Number of Courses : 23

Total Number of Courses having changes : 15

Percentage of Revision : 65.2 %

Note:

The content of the syllabus which has been revised is highlighted.

M.Sc., BOTANY (2017 – 2018)

Sl. No.	SEM	Category	Paper Code	Title of the Paper	Maximum Marks			Minimum Marks for Pass			Hours Week	Credits
					CIA	E.E	Total	CIA	E.E	Total		
1	I	Core	17P1BOC1	Plant Diversity I (Algae, Fungi, Lichen and Bryophytes)	25	75	100	10	30	50	6	4
2		Core	17P1BOC2	Environmental Biotechnology	25	75	100	10	30	50	6	4
3		Core	17P1BOC3	Cytology, Genetics and Plant Breeding	25	75	100	10	30	50	6	4
4		Core PL	17P1BOCP1	Practical - I	40	60	100	16	24	50	6	5
5		Major Elective-I	17P1BOEL1A 17P1BOEL1B	Biofertilizer Technology Biofuel Technology	25	75	100	10	30	50	6	4
6	II	Core	17P2BOC4	Plant Diversity – II (Pteridophytes, Gymnosperms and Paleobotany)	25	75	100	10	30	50	5	4
7		Core	17P2BOC5	Angiosperms, Anatomy, Embryology and Microtechniques	25	75	100	10	30	50	5	4
8		Core	17P2BOC6	Molecular Biology and Genetic Engineering	25	75	100	10	30	50	5	4
9		Core	17P2BOC7	Herbal Science and Phytotherapy	25	75	100	10	30	50	5	4
10		Core PL	17P2BOCP2	Practical - II	40	60	100	16	24	50	5	5
11		Major Elective-II	17P2BOEL2A 17P2BOEL2B	Horticulture Food Processing and Preservation	25	75	100	10	30	50	5	4
12	III	Core	17P3BOC8	Plant Taxonomy and Economic Botany	25	75	100	10	30	50	5	4
13		Core	17P3BOC9	Microbiology and Plant Pathology	25	75	100	10	30	50	5	4
14		Core	17P3BOC10	Plant Biotechnology	25	75	100	10	30	50	5	4
15		Core	17P3BOC11	Bionanotechnology	25	75	100	10	30	50	5	4
16		Core PL	17P3BOCP3	Practical - III	40	60	100	16	24	50	5	5
17		EDC	17P3BOEDC	Medical Botany and Pharmacognosy	25	75	100	10	30	50	4	
				Communicative Skill and Personality Development	-	-	-	-	-	-	1	
18	IV	Core	17P4BOC12	Research Methodology	25	75	100	10	30	50	5	4
19		Core	17P4BOC13	Plant Physiology, Biochemistry and Biophysics	25	75	100	10	30	50	5	4
20		Core PL	17P4BOCP4	Practical - IV	40	60	100	16	24	50	6	5
21		Major Elective-III	17P4BOEL3A 17P4BOEL3B	Applied Phycology Mushroom Technology	25	75	100	10	30	50	6	4
22		Project	17P4BOPR	Project	40	60	100	16	24	50	2	4
23		CN	17P4BOCN	Comprehension	-	100	100	-	-	50	5	2
				Communicative Skill and Personality Development	-	-	-	-	-	-	1	
				Total			2300				120	90

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
I	17P1BOC1	Plant Diversity I (Algae, Fungi, Lichens and Bryophytes)	6	4

Objectives

- ❖ 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

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

Laboratory culture methods – isolation, kinds of culture – culture media for freshwater, (Chu-10 medium and Pringsheim) and marine algae (Guillard F-2 medium) – cultivation methods of micro and macro algae, pollution – algal bloom and its effect on algal growth – Industrial uses of algae. **fossil algae.**

Unit III

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

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

Unit V

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

Books for Reference

- Kumar, H.D. and Singh, H.N., (1971). A text book of Algae. East West Press Pvt. Ltd., New Delhi.
- Bold, H.C. and Wynne, M.J., (1978). Introduction of Algae-structure and reproduction, Prentice Hall, New Jersey.
- Vasistha, B.R., 1977. Botany for Degree students- Part – I. Algae. S. Chand and company Ltd. Ram Nagar, New Delhi
- Alexopoulos, C.J., (1973). Introductory Mycology. Wiley Eastern Private Ltd., New York.
- Gangulee and Kar, College Botany, Vol. II, New Central Book Agency, Calcutta.
- 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
I	17P1BOC2	Environmental Biotechnology	6	4

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

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

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

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

Unit IV

Conservation of resources – **IUCN, Red list categories, Endemism, Biodiversity, Hotspots,** Endangered flora and fauna,– Red Data Book – Conservation strategies, Ex-situ approach, tissue culture and cryopreservation, gene bank, pollen bank and seed bank. In-situ approach,– Biosphere reserves. National parks and Sanctuaries –The Environmental Protection Act–1986.Convention on Biological Diversity (CBD)

Unit V

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

Books for Reference

- Ignacimuthu, S.J, (1996). Applied Plant Biotechnology. McGraw Hill Publications, Co., Ltd., New Delhi.
- Kudesia, V.P. and Kudesia, R.,(1978). Environmental Health and Technology. McGraw Hill Publications Co., Ltd., New Delhi.
- Harvinder Sohal and Srivastava, A.K.,(1982). Environmental and Biotechnology, Blackwell Publishers, New Delhi.
- Kumar, H.D., (1982). Modern Concepts of Ecology–Vikas Publishing House Pvt. Ltd.
- Sathyanarayana .U. (2007). Biotechnology .Books & Allied (p) Ltd, Kolkata.
- Olguin, E.J., Sanchez, G. and Hernandez, E., (2003). Environmental Biotechnology and Clean air Bioprocess. Taylor and Francis

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
I	17P1BOC3	Cytology, Genetics and Plant Breeding	6	4

Objectives

- ❖ To enable the students to understand the ultra structure 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

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

Detailed study of nucleus, chromosome-types, structure, organization (solenoid model) structure changes and number of chromosomes. DNA as a genetic material - cell cycle. cell division, Mitosis and Meiosis

Unit III

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

Unit IV

Multiple alleles. Linkage and crossing over-(concepts) 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

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. **Role of transposons in plant breeding.**

Books for Reference

- Gupta, P.K.(1985) - A text book of Cytology, Genetics & evolution.Rastagi Publications.,Meerot – 250002.India
- Verma and Agarwal (1979) Cytology.S .Chand & Company .Ltd, New Delhi.
- 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	17P1BOCP1	Core – PL I - Plant diversity – I, Environmental Biotechnology and Cytology, Genetics and Plant Breeding	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**Internal structure of *Parmelia*****Environmental Biotechnology**

Water Pollution – Effects – demonstration

Sewage water analysis

- Alkalinity
- Free CO₂
- Chloride
- Dissolved oxygen
- Calcium hardness
- Magnesium hardness

Remote sensing – applications

Microbes of polluted waters

Microbes of oil contaminated soil

Biofertilizer, Isolation and mass multiplication of *Rhizobium*

Vermicompost – preparation of *Vermicompost*

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
I	17P1BOEL1A	Major Elective - I Biofertilizer Technology	6	4

Objectives

- ❖ 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

General account of the microbes used as biofertilizers for crop plant and their advantages. Symbiotic N₂ fixers: *Rhizobium* – Isolation, Characterization, identification classification, inoculum production and field application – Nitrogen fixation – Nif genes -Bradyrhizobium and Azorhizobium. Frankia – Isolation, actinorrhizal nodules, non – leguminous crop symbiosis.

Unit II

Free living – associative – Non-symbiotic N₂ fixers: *Azospirillum* – Isolation, Characterization, mass inoculum production and filed application. *Azotobacter* – isolation characterization, mass inoculums production and field application.

Unit III

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

Unit IV

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

Unit V

Mycorrhizal bioinoculants – Types, classification and their importance – Ectomycorrhizae, Endomycorrhizae, Ectendomycorrhizae – Isolations of AM spore and assessment of AM infection in roots. – Mass inoculum production and Field applications of Ecto and VAM. Potash mobilizers (*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

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

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	17P2BOC5	Angiosperms, Anatomy, Embryology and Microtechnique	5	4

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

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.

Unit II

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.

Unit III

Embryology of Angiosperms - Structure and development of microsporangium – microsporogenesis – ultra structure of microspore – pollen viability test – morphology, cytology and physiology of anther tapetum – pollen embryosa – microsporangium – microsporogenesis – types of embryosa – **Endothelium** - sexual incompatibility.

Unit IV

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.

Unit V

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

Books for Reference:-

- Cutter, E.G., (1965). Plant Anatomy- Experiment and Interpretation. Part I Cells and tissues, Edward Arnold London.
- Cutter, E.G., (1971). Plant Anatomy -Experiment and Interpretation. Part II Organs, Edward. Arnold London.
- Bhojwani and Bhatnagar, (1990). Embryology of Angiosperms, VikasPublishing House (P) Ltd., New Delhi.
- Swamy, B.G.L. and Krishnamoorthy, M.V., (1980). From Flower to Fruit, Tata McGraw Hill Publishing Co., New Delhi.
- Wardlaw, C.W., (1976). Embryogenesis in Plants, Methner and Co. London.
- Raghavan,V.,(1976). Experimental Embryogenesis in Vascular Plants Academic Press, London.
- Prasad, M.K. and Krishna Prasad, M.,(1975). Outlines of Microtechnique, Emky Publications, Delhi.
- Johri, B.M. (1984) Embryology of Angiosperms Springer – verlag, New,Delhi.
- Eames, A.J. Mac Daniels, L.H. (1972) Tata Mc Graw- Hill Publishing company Ltd, New Delhi.
- Annie Ragland, (2010).Plant Anatomy and Microtechnique. Saras publications, Nagarcoil.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	17P2BOCP2	Core – PL II – Plant Diversity II, Plant Anatomy, Embryology, Microtechnique, Molecular Biology and Genetic Engineering and Herbal Science and Phytotherapy	5	5

Objectives

- ❖ 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)
RAPD
Polymerase Chain Reaction – Procedure
C DNA synthesis

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.

Herbal sciences and phytotherapy

Preparation of herbal drinks and herbal salad – Submission of mini project.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	17P2BOEL2A	Major Elective – I Horticulture	5	5

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

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. Green house and shade house.

Unit II

Fruit crops - growth regulators – 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*).

Unit III

Principles and methods of designing a flower (out-door) garden - hedges, sedges, fences, trees, climbers, rockeries, arches, terrace garden, lawn making and maintenance, arboriculture, water garden – cultivation of water plants, common water plants.

Unit IV

Indoor gardening – factors, light, humidity, watering, designing - Bonsai plants – watering, pruning, dwarfing - Flower arrangement and decoration – Wet decoration – dry decoration cultivation of commercial flower crops – Rose, Jasmine, (Jasmine concrete), Chrysanthemum.

Unit V

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

Book for Reference:

- Text Book of Horticulture – K.Manibushan Rao (1991) McMillan.
- Introduction to Horticulture – N.Kumar (1986) Rajalakshmi Publishers.
- A Guide on Horticulture–J.S.Sundararaj, S.Muthusamy, Dr.K.G.Shanmugavelu, R.Balakrishnan.
- Horticulture – Principles and Practices George Acquah.
- Bose,U.S., (2012) Hand Book of Horticulture Oxford Book Company New Delhi-110002
- Russeii,G.E.(1985).Progress in plants breeding. University.
- Hertmann,H.T., Keiter, D.E,Davies,F.T., Geneeve, R.2., (1997) Plant Propagation – Principles and practices. Prentice – Hall of d India Pvt. Ltd. New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	17P3BOC8	Plant Taxonomy and Economic Botany	5	4

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

A brief study on morphology of Angiosperms (Leaves, inflorescence, flower and fruit) - System of Classification: Artificial Systems - Linnaeus; Natural Systems - Bentham & Hooker; Phylogenetic Systems - Hutchinson, Takhtajan, **APG III**

Unit II

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

Unit III

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; (**RAPD, RFLP, ISSR; ; DNA barcoding (Principle and applications)**)

Unit IV

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

Unit V

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

- Gangulee Das and Kar College Botany, Vol. II, New Central Book Depot, Calcutta.(1992)
- George, H.M. Lawrence (1967) Ed. Taxonomy of Vascular plants, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Shrivastav .L.K., Nene.M.C. and Joshi. G.V., (1971) Elements of Botany, Third Ed.Kityab Mahal,Allahabad.
- Pandey.H.P. (2009) Plant taxonomy (Principle of practice), Silver Economic Botany, Silver Line Publications, Faridabad.
- Das.P.C. (2009) Economic Botany A.I.T.B.S. Publishers, India.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
III	17P3BOC9	Microbiology and Plant Pathology	5	4

Objectives

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

Unit I

Classification of microorganisms (**Bacteria-Bergey's Manual 12th Ed.**) Fungi, Viruses, micro 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 mycoplasma.

Unit II

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 Spherosphere. Industrial Microbiology a industrial fermentation (alcohol).

Unit III

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 IV

Plant and microbes interaction diseases caused by bacteria (Blight of Paddy, Black arm of cotton), fungi (Blast of paddy, Red rot of sugarcane), **Tikka disease of groundnut Diseases** caused by virus (Bunchy top of Banana and TMV), Diseases caused by Mycoplasma, (Citrus stubborn, Corn stunt) - Control of plant diseases – cultural, physical, chemical and biological methods - **Integrated pest management system (IPM).**

Unit V

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

Books for Reference

- Schlegel, H.S., (1986). General Microbiology 6th Ed. (Translated by M.Kugut) Cambridge University Press, London.
- Pelczar, Reid & Chan, (1986). Microbiology Tata Mac. Hill, New Delhi.
- Walker, J.C., (1953). Plant Pathology.
- P.D. Sharma.,(2007) Microbiology and plant pathology 2nd Ed. Rastogi publications, Meerut., India.
- Johnston, A. and Booth, C., (1983). Plant Pathologists "Pocket book" 2nd Ed. Common Wealth Mycological Institute London.
- Rengaswami, G., Diseases of crop Plants in India.
- 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
III	17P3BOC10	Plant Biotechnology	5	4

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

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

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

Unit III

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

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 **CaMV,SV40**; Direct gene transfer – Electroporation, Micro injection, Biolistic missiles, Ca^{++} ion under high pH. **Blotting technique – southern, northern and western.**

Unit V

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

- Bhojwane, S.S. and Razdan, M.K., Plant Tissue Culture: Theory and practice, Elsevier Science.
- Gupta, P.K., Biotechnology – Rastogi Publications, Meerut.
- Singh, B.D., (1988). Biotechnology – Kalyani Publishers, Ludhiana.
- Plant Secondary metabolite K.G.Ramawat (S.Chand).
- Satgiyanarayana, U. (2007) Biotechnology Book and Allied (p) Ltd.Kolkata.
- Ignacimuthu, S. (2015) Reprint) Narose Publishing House, Pvt Ltd, New Delhi.
- Gupta, P.K., Elements of Biotechnology. Rastogi publications, New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	17P3BOCP3	Core – PL III - Plant Taxonomy, Economic Botany, Microbiology, Plant Pathology and Plant Biotechnology	5	5

Objectives

- ❖ To identify the families of plants in the theory syllabus.
- ❖ To prepare dichotomous keys.
- ❖ To identify economically important plants and 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.
- To gain knowledge about diversity of plants through compulsory Botanical tour and submission of herbarium

Biotechnology (Demonstration / Charts / Photographs)

- Media Preparation
- Callus induction
- Protoplast Isolation
- Meristem culture
- Industrial Fermentation Model
- Mini – Biogas Model
- Culturing of Biofertilizers
- Bioinsecticides
- Antibiotics
- SCP –Spirulina

Microbiology

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

- Isolation of microbes from soil
- Gram staining of bacteria
- Presumptive test
- 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 of 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 Disease of Groundnut.
- Baiting Technique – using sunflower seeds
- Demonstration of cell wall degrading enzyme activity by Rhizopus / Fusarium on Potato tuber discs.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
IV	17P4BOC12	Research Methodology	5	4

Objectives

- ❖ To make the students to learn the physiological techniques.
- ❖ To train the students to understand the main principles in biostatistics
- ❖ To make the students apply statistical principles to 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 understand the problem selection and project design
- ❖ To lay a strong foundation for the students to understand the basics of research and report preparation

Unit I

Principle and application of phase contrast fluorescence, scanning and transmission electron microscopy Principle, instruments and applications: centrifuge-Rotors –Ultra centrifuge –GM counter, scintillation counter, –chromatography –affinity and HPLC –, UV . Vis Spectrophotometer – flame photometer – Atomic absorption Spectrophotometer –Electrophoresis –SDS PAGE

Unit II

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 regression - Introduction to MANIVA and SPSS-use of statistical softwares.

Unit III

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. Websites addresses – Information in the web – Internet file types –saving internet text. E.mail Attaching files – searching the net. Data Bases: Nucleic acid sequence (EMBL, Gen Bank, DDBJ) and Protein sequence Data bases (PIR, MIPS, SWISS-PROT, **TREMBL**, PDB).

Unit IV

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 V

Journal: Standard of research journals –paid and refereed journals –impact factor ,citation index, H-index. Science citation index- Choice of journals for publication. Information retrieval : access to archives and databases, search engines: Google , Pubmed, NCBI,– Online data base library –Plagiarism.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	17P4BOCP4	Core – PL IV – Research Methodology and Plant Physiology	6	5

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

- Preparation of Index cards.
- Preparation of bibliography
- Proof correction
- Exercises in the calculation of citation index
- Determination of impact factor of Author ,Article and Journal.
- Preparation of standard graph for sugars
- Preparation of standard graph for amino acids
- Preparation of standard graph for proteins
- Identification of instruments / their parts and their applications
- Preparation of computer graphs and diagram using MS Excel of usage of power point
- Biostatistics problems.

Plant Physiology Practical

- Preparation of Buffers.
- Study of Hill reaction with isolated chloroplasts
- Separation of amino acids by paper chromatography
- Separation of pigments by paper chromatography
- Separation of pigments by thin layer chromatography
- Estimation of soluble sugars
- Estimation of protein
- Estimation of amino acids
- Estimation of starch
- Determination of saponification value of fatty acids
- Estimation of xanthophylls and carotene from the given material
- Finding out the absorption spectrum of chlorophyll from the given material
- Assay of nitrate reductase activity
- Assay of GS activity
- Assay of Catalase activity

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	17P4BOEL3A	Major Elective – I Applied Phycology	6	4

Objectives

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

Unit I

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

Unit II

Mass cultivation of commercially valuable marine macro algae (Mariculture-Gracilaria,) – the extraction of agar-agar, carrageenan, alginates and other minerals. Isolation methods of algal strains. Media for the culture of micro algae (ASN₃, BG11) and macro algae (Guillard, F/2).

Unit III

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; Saprobian index.

Unit IV

Eutrophication – Types and its impacts algal blooms - toxic algae - control of nuisance algae –Source of algal cultures: algal culture collection of the world – Genetic modification of algae.

Unit V

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

Books for Reference

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