

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 | |

M.Sc., BOTANY (2017 – 2018)

| Paper Code | Total No. Of Papers | Total Marks | Total Credits | Classification |
|-------------------------------|----------------------------|--------------------|----------------------|-----------------------|
| Core | 17 | 1700 | 72 | ✓ |
| Elective | 3 | 300 | 12 | ✓ |
| E.D.C | 1 | 100 | --- | ✓ |
| Project | 1 | 100 | 4 | x |
| Comprehension | 1 | 100 | 2 | ✓ |
| Soft skill using Language lab | -- | -- | --- | X |
| Total | 23 | 2300 | 90 | |

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

**Question Pattern for UG and PG Programmes for students to
be admitted during 2017 – 2018 and afterwards**

Total Marks: 75

QUESTION PATTERN

**SECTION – A
(Question 1 to 10)**

10 x 2 = 20 Marks

1. Short Answer Questions
2. Two Questions from each units (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 | 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 byrophytes. 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.
- Vasisthta, 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 transposans 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, Fritschiella, 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 field 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 – field 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 |
|----------|--------------|---|--------------------------|----------------|
| I | 17P1BOEL1B | Major Elective – II Biofuel Technology | 6 | 4 |

Objectives

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

Unit I

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

Unit II

The substrate – Industrial and food processing wastes, domestic and municipal wastes. The microorganisms – Hydrolytic and fermentative bacteria, Syntrophic H₂ producing bacteria, Methanogenic bacteria, Acetogenic bacteria. The process of biogas production - Factors affecting biogas yields - Precautions, Advantages and Disadvantages.

Unit III

Bioethanol Vs 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

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

Unit V

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

- Bullock, J.D. and Kristiansen, B., (1987). Basic Biotechnology, Academic Press, New York. PP: 9337 – 358.
- Hobson, P.N. and Whatiey, A.D., (1993). Anaerobic Digestion, Modern Theory and Practice. Elsevier, London.
- 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.
- Leach, C.K. and Van Dam-Mieras, MCE., (1994). Biotechnological Innovations in Energy and Environmental Management Butterworth – Heinemann Ltd., Oxford.
- Lembi, L.R., Cuashman, J.H., Nichols, R.J. and Wyman, C.E., (1991). Fuel ethanol from cellulosic biomass, Science 251.
- Meyers, R.A., Molecular Biology and Biotechnology. A comprehensive Desk Reference VCH Publishers, Inc. New York.
- Woods, D.R., (1993). Clostridia and Biotechnology, Butterwords Oxford.
- 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 |
|----------|--------------|--|--------------------------|----------------|
| II | 17P2BOC4 | Core – I Plant Diversity II (Pteridophytes, Gymnosperms and Paleobotany) | 5 | 4 |

Objectives

- ❖ 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

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

Unit II

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

Comparative study of the vegetative and reproductive characteristics of the following orders Pteridospermales (Lyginopteridaceae, Medullosaceae) Bennettiales (Williamsoniaceae) and Pentoxylales (Pentoxylaceae).

Unit IV

Gymnosperms - General characters– Classification (K.R.Sporne, 1965) Evolutionary trends and phylogenetic relationship among various groups of Gymnosperms. Cycadales, Coniferales, Taxales, Ginkgoales and Gnetales – Economic importance of Gymnosperms.

Unit V

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

Books for Reference

- Sporne, K.R. and Hutchinson Co., (1970). The Morphology of Pteridophytes, London.
- Rasheed, (1976). Pteridophyta, Vikas Publications, New Delhi.
- Sporne, K.R. and Hutchinson Co., (1970). The Morphology of Gymnosperms, London.
- Vasishta, P.C. and Ghand, S., (1996). Gymnosperms, Ghand and Company Ltd., New Delhi.
- Arnold, C.I.A., (1947). An introduction to Paleobotany –McGraw-Hill, New York and London.
- Parihar, N.S., (1967). The Biology and Morphology of Pteridophytes by New Central Book, Depot Allahabad.
- Living Cycads by Chamberlain.
- College Botany Vol. II by Gangulee and Kar, New Central Agecny, Calcutta.(1959)
- Gnetales by Pearson.
- Gnetales by Maheswari and Vasil
- Gymnosperms by Chamberlain.

| 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 embryosaac – microsporangium – microsporogenesis – types of embryosaac – 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 | 17P2BOC6 | Molecular Biology and Genetic Engineering | 5 | 4 |

Objectives

To enable the students:

- ❖ To know the structure of nucleic acid.
- ❖ 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

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.

Unit II

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.

Unit III

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

Unit IV

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

Unit V

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

Books for Reference

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

| Semester | Subject Code | Title of the Paper | Hours of Teaching /Week | No. of Credits |
|----------|--------------|---------------------------------|-------------------------|----------------|
| II | 17P2BOC7 | Herbal Science and Phytotherapy | 5 | 4 |

Objectives:

- ❖ To enable the students to identify local medicinal plants.
- ❖ To enable the students to learn the uses of medicinal plants as natural medicines alternative to the existing allopathic medicine.
- ❖ To impart the students knowledge on botany and phytochemistry of medicinal plants.
- ❖ To make the students to cure common human ailments with medicinal plants.

Unit I

Introduction to Medical botany– History of Medicinal plants – Classification, Vernacular name Geographical source– Ethnobotany – Traditional and Folklore medicine – Native medicine. Ecological habitats of medicinal plants. Traditional Indian systems of medicine: Ayurveda, Siddha, Unani, Homeopathy and Naturopathy.

Unit II

Cultivation, Collection and processing of herbal drugs – Macroscopic characters (Physical and Organoleptic). Therapeutic and Pharmaceutical uses of the following medicinal plants: Rhizome (*Zingiber officinale*), Root (*Glycyrrhiza glabra*), Leaves Solanum (*trilobatum*, *Eclipta*), Flower (*Hibiscus rosa-sinensis*), Fruit (*Carica papaya*),

Unit III

Seed (*Strychnos nux-vomica*), whole plant (*Andrographis paniculata*), Fixed oils. Cultivation and utilization of selected medicinal plants – *Bacopa monnieri*, *Phyllanthus amarus* herbal farms and Biotechnological methods - Role of NMPB in cultivation and marketing of medicinal plants.

Unit IV

Pharmacognosy – Definition and scope, Drug adulteration, Drug evaluation - Chemical, Physical and Biological methods. Phytochemical investigation, Standardization and Quality control of herbal drugs. Drugs containing Glycosides (*Cassia angustifolia*), Tannins (*Terminalia chebula*), Lipids (*Arachis hypogea* oil) Resin (*Cannabis sativus*) and Alkaloids (*Vinca rosea*). IPR and patenting

Unit V

Preparation of Herbal Powders, Shampoo, Oil, Infusions, and Tinctures; Herbal Foods- Salad, Sprouts-Herbal Drinks -Tea, Soup; Herbal medicines for Human ailments: Heart, Lung, Kidney, Liver, Skin, Hair, Stomach, Diabetes, Cold, Cough, Joint Pain disorders.

Books for Reference:

- Kumar, N.C. (1993) An Introduction to Medical Botany and Pharmacognosy,
- Balu, S, Pandiyan, P. and Murugan, R. (2005) Herbal Technology, Dept. of Botany & Microbiology, A.V.V.M Sri Pushpam College, Poondi.
- Nadkarni, (1981) Indian Materia Medica,
- Gamble, J.S. Flora (1973). of the Madras Presidency,
- Jani, S.K., (1980) Indian Medicinal plants,.
- Michael Heinrich, Joanne Barne, Simon Gibbons and Elizabeth, M. Williamson. (2012), Fundamentals of Pharmacognosy and Phytotherapy Elsevier Ltd ISBN: 978-0-7020-3388-9
- Kirtikar, K.R. Basu, B.D. (1991.) Indian Medicinal plants Vol. I to V. Dehradun.

| 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 |
|-----------|-------------------|---|--------------------------|----------------|
| II | 17P2BOEL2B | Major Elective – II Food Processing and Preservation | 5 | 4 |

Objectives

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

Unit I

Vegetable and vegetable products: Canning of vegetable, pickles, chutneys, etc., Baked Products flour preparation baking formulation, processing. Milk and milk products milk and milk products butter, lassi, condensed milks- cheese, and milk powder.

Unit II

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

Unit III

Food additives: Definition – preservatives – anti-oxidants – colouring agents, emulsifier, stabilizers and thickeners, antifoaming agents, nutrient supplements, non-nutritive sweetness; functions of additives. Food adulteration – adulterants and simple detection techniques – food grades – standards, laws and regulations.

Unit IV

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 V

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, sulphites, diethylpyrocyanates (DEPC), Hydrogen Peroxide carrageenan CO₂, Carrageenan Preservation by antibiotics and irradiation. Preservation by cold storage, Preservation by sugars.

Books for Reference:

- 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.
- Giridharilal, Siddappa, G.S. and Toandon, G.L. Preservation of Fruits and Vegetables – CFTRI, Mysore.
- S.Ranganna – Hand book of analysis and quality control for fruit, vegetables products – CFTRI, Mysore.
- Vijayaramesh, K. (1967). Food Microbiology, MJP Publisher.
- George, J. Banwat (2004) Basic Food Microbiology, Second Edition, CBE Publishers and Distributors, New Delhi.
- William. C. Frazier and Dennis .C. Westhoff (2008), Food Microbiology, Fourth Edition Tata McGraw –Hill publishing Company Limited.

M.Sc. Botany

| 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 Spermosphere. 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 & Nopalins (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,NEew De4lhi.
- 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 | 17P3BOC11 | Bionanotechnology | 5 | 4 |

Objectives:

- ❖ To understand the biological systems that operate in nano level are taught along with instrumentation to facilitate such studies .
- ❖ To understand the importance of future global with perspective of this technology in the next waves of industries is informed
- ❖ To understand this field for the students to explore the naturally occurring nanotechnology and to use biotechnology to harness and modify these nonomechines
- ❖ To understand of this technology in exemplified in molecular medicine and diversity systems.

Unit I

Definition, History of Nanoscience – Need of nanotechnology Hurdles for Nanotechnology development – Present status of nanotechnology – Future of nanotechnology – Biotechnology of Bionanotechnology – Nanotechnology and its types, Magnitude – size, shape, and phase, of molecules – top down and bottom up approaches Modern bionano material protein, nucleic acid and lipids used for carrying information – polysaccharides application in nanotechnology

Unit II

Clearing of air with nanotechnology -Nanomaterials used in environment-Nanotechnology for water treatment- Microbial nanoparticles- Biosensor- Nanoliner optical processes with intense laser beam – photo induced effects in biological systems - Carbon fullerene -Nanotubes - nanopores -nanowires- nanogeres - nanochannels - nanotransistors – proteases nanolithography (quantum dots)-microparticles, Nanorobots. Nanoscience in India and abroad looking at ethics and society

Unit III

Nanotechnology in gene therapy –stem cell technology –PCR-ELISA-DNA Profiling and blotting techniques, nanopotes, Nanocrystals -DNA and protein based nanocircuitry- Micro array –Its types – fabrication – Standardization.

Unit IV

Nanotechnology drug developments from plants –nanotechnology for drug solubilization and drug delivery – diagnosis using nanomaterials –nanotherapy for disease treatments – interior ertory expressions –Replacing joints with better stuff – Radioactive tuberene cages –Nuclear medicine.

Unit V

Atomic force microscope Scanning -Electron Microscope and Confocal microscope FISH. Dynamic light scattering XRD. Engineering biological system- tissue engineering-artificial inorganic composites- prospects and problems – industries and institutions.ERD

Books for Reference:

- Goodsell DS (2004) Bionanotechnology lessons from nature. Wiley-Liess, Inc., Hoboken, New Jersey. ISBN 0- 471-41719-X
- Lindsay SM., (2010) Introduction to Nanoscience. Oxford University press. ISBN-13-978-019-959129-9.
- Mark Ratner and Daniel Ratner (2003), Nanotechnology Person educationa INC. Publ. ISBN -81-7758-743-9.
- Recharh Brookes and Earl Boysen (2006) Nanotechnology wiley publishing Ine. InPP361.
- Dukkrnix A. and Giege (1992) crystallization of Nucleic acids and protein practical approach .Oxford university Preez England
- Subbiah Balaji-(2008) Nanotechnology- MJPublisher HO: NewNo5, Muthukalathy Street, Triplicane Chennai 600 005 www . mippublishers
- S. Shanmugam -(2011) Nanotechnology- MJPublisher, 47, Nallathambi street Triplicane, Chennai www . mippublishers
- Ignacimuthu – (2009) Biotechnology –An Introduction second edition.
- Vinitha Singh- (2010) Bionanotechnology. Advanced learner press 7/33, Ansari Road Daryagani New Delhi.
- M. Balakrishnan Rao and Krishna Reddy (2007) Campus Books International ,4531124, Prahlad street Ansai Road, Daryaganj, New Delhi-11002 India-Email Campus Books@hotmail.com.

| 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

Principale 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.

Books for Reference

- Jayaraman, J., (1972). Techniques in Biology, Higginbotham's, Pvt. Ltd., Madras.
- Jayaraman, J., (1985). Laboratory Manual in Biochemistry, Wiley Eastern Ltd., New Delhi.
- Connor & Peter Woodford, (1979). Writing Scientific Paper in English Pitman, Medical Pub. Co., Ltd., England.
- Balagurusamy, E., (1985). Programming in BASIC, 2nd Ed., Tata McGraw Hill Pub. Co., New Delhi.
- Dheenadayalu, R., (1987). Computer Science, Vol-I Tata McGraw Hill Pub. Co., Ltd., New Delhi.
- Khan, I.A., and Khanum, A., (1994). Fundamentals of Biostatistics, Vikas Pub., Hyderabad.
- Kothari, C.R., (1991). Research Methodology – Methods and Techniques, Wiley Eastern Ltd., New Delhi.
- Sree Ramulu, V.S., (1988). Thesis Writing, Oxford & IBH Pub., New Delhi.
- Zar, J.H., (1984). Biostatistics Analysis, Prentice Hall International, England Cliffs, New Jersey.
- Attwood Teresa, K., Parry, Smith and David, J., (2001). Introduction to Bioinformatics cell and molecular Biology in Action series Pearson Education (Asia) New Delhi.
- 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 |
|-----------|------------------|--|--------------------------|----------------|
| IV | 17P4BOC13 | Core – II Plant Physiology, Biochemistry and Biophysics | 5 | 4 |

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

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 II

Metabolic Pathways: Photochemical phase– Photosystem I and II and their components - Emerson effect – Electron transport in PS I and PS II. Photolysis of water, Photophosphorylation. Carbon fixation: C3, C4 and CAM pathways, Kranz anatomy and its types, Photorespiration and its significance. Carbohydrates–Monosaccharides and polysaccharides.

Unit III

Respiration: Glycolysis, TCA cycle, Pentose phosphate pathway and terminal oxidation– Anaerobic respiration and fermentation. Lipid Metabolism. β -oxidation. Fate of acetyl–COA Glyoxylate cycle. Significance, Fat synthesis (Synthesis 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 IV

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.

Unit V

Biophysics: Thermodynamics – Redox reaction – Energy coupling reactions – Energy rich compounds – ATP, NADPH₂, FADH₂, 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.

Books for Reference

- Lehninger, (1982). Principles of Biochemistry – C.B.S. Pub and distributors, New Delhi.
- Bidwell, R.G.S., (1979). 2nd Ed., Plant Physiology, Mcmillan Pub. Co., Inc. New York.
- Devlin, R.M. and Witham, F.H., (1982). 4th Ed., Plant Physiology C.B.S. Pub. and distributors New Delhi, 32.
- Noggle, R. and Fritz, G.J., (1989). 2nd Introduction of Plant Physiology. Prentice Hall of Indian Pub., Ltd., New Delhi.
- Salisbury, F.B. and Ross, (1974). Plant Physiology – Prentice hall, India Ltd.,
- Jain,V.K. (2015) Fundamentals of Plants physiology , S.Chand and Company Ltd.
- Verma.V. (2011) Text Book Pvt.Ltd. New Delhi.
- Satyanarayana .U. and Chakrapani.U. (2010) Essentials of Biochemistory, Books and allied (p) Ltd.Kolkata.
- Narayanan.P, (2008) Essentials of Biophysics New Age International Publishers, New, Delhi.

| 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.

| Semester | Subject Code | Title of the Paper | Hours of Teaching / Week | No. of Credits |
|-----------|-------------------|--|--------------------------|----------------|
| IV | 17P4BOEL3B | Major Elective - II Mushroom Technology | 6 | 4 |

Objectives

- ❖ 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

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

Unit II

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

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

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

Food Preparation:

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

Books for Reference:

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

CORE OPTIONAL PAPERS

| Semester | Subject Code | Title of the Paper | Hours of Teaching / Week | No. of Credits |
|----------|--------------|--|--------------------------|----------------|
| I | | Core Optional - Evolution and Behaviour | - | - |

Objectives:

- ❖ To know the emergence of evolutionary thoughts
- ❖ To learn the origin of cells and unicellular evolution.
- ❖ To know the paleontology and evolutionary history.
- ❖ To know the molecular evolution and population genetics

Unit I

Emergence of evolutionary thoughts: Lamarck; Darwin—concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; the evolutionary synthesis.

Unit II

Origin of cells and unicellular evolution: Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; concept of Oparin and Haldane; experiment of Miller (1953); the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.

Unit III

Paleontology and evolutionary history: The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multicellular organisms; major groups of plants and animals; stages in primate evolution including Homo.

Unit IV

Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence.

Unit V

The Mechanisms: Population genetics – populations, gene pool, gene frequency; Hardy-Weinberg law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; adaptive radiation and modifications; isolating mechanisms; speciation; allopatricity and sympatricity; convergent evolution; sexual selection; co-evolution.

Books for Reference

- Edward M. Barrows (2001). *The Animal Behaviour Desk Reference: A Dictionary of Animal Behaviour, Ecology and Evolution* (Second Edition). CRC Press LLC.
- Anderson, Judith. 1989. A methodological critique of the evidence for genetic similarity detection. *Behavioral and Brain Sciences*, 12:3 p.518
- hilippe Rushton, J.P., (1995). *Race, Evolution, and Behavior: A Life History Perspective* 3rd Ed., Transaction Books, later The Charles Darwin Research Institute London School of Economics University of Oxford.
- Weizmann, Fredric (November 2001). *Race, Evolution, and Behaviour: A Life History Perspective* (Review) . *Canadian Psychology*.
- Kondalkar, V.G., (2007). *Organizational Behaviour*. New Age International (P) Limited, Publishers. 4835/24, Ansari Road, Daryaganj, New Delhi – 110002 Visit us at www.newagepublishers.com

| Semester | Subject Code | Title of the Paper | Hours of Teaching / Week | No. of Credits |
|-----------|--------------|--|--------------------------|----------------|
| II | | Core Optional - Cell Communication and Cell Signaling | - | - |

Objectives

- ❖ To know the host parasite interactions.
- ❖ To learn the cell signaling and pathways
- ❖ To learn the interaction of cancer cells with normal cells
- ❖ To know the innate and adaptive immune system

Unit I

Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

Unit II

Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component signaling systems, bacterial chemotaxis and quorum sensing.

Unit III

Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

Unit IV

Cancer: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

Unit V

Innate and adaptive immune system: Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules, generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell mediated immune responses.

Books for Reference

- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. (2002). *Molecular Biology of the Cell*, 4th edition New York: [Garland Science](#); ISBN-10: 0-8153-3218-1 ISBN-10: 0-8153-4072-9.
- Dr. Abhijit Mitra (2009). *Lecture Notes on Mobile Communication*. A Curriculum Development Cell Project Under QIP, IIT Guwahati. Department of Electronics and Communication Engineering. Indian Institute of Technology Guwahati. Guwahati , 781039, India.
- Hausman, Geoffrey M. Cooper, Robert E. (2000). [Signaling Molecules and Their Receptors](#). In NCBI bookshelf. *The cell: a molecular approach* (2nd Ed.). Washington, D.C.: ASM Press. [ISBN 087893300X](#)

| Semester | Subject Code | Title of the Paper | Hours of Teaching / Week | No. of Credits |
|------------|--------------|--|--------------------------|----------------|
| III | | Core Optional - Wood Technology | - | - |

Objectives

- ❖ To know the significance of wood.
- ❖ To know the properties of wood
- ❖ To identify the defects of wood due to fungi and insects
- ❖ To know the methods of wood preservation

Unit I

Microscopic structure of wood: Vessels, Tyloses, Tracheids, Fibres, Wood parenchyma - Wood rays, Grain and Texture. Organisation of the cell wall - Microfibril - Orientation, cell wall pit - structure. Identification and classification of wood.

Unit II

Chemical composition of wood, structure and properties of Cellulose - Hemicellulose - Wood polysaccharides and Lignin. Distribution of chemical constituents in wood. Physical properties of wood - Colour - Lustre - Fluorescence - Odour and Weight.

Unit III

Mechanical properties of wood - Bending properties - Composition - Hardness - Shear. Properties of Dicot and Monocot wood. Growth rings in wood - Annual rings, early wood and late wood, soft wood and hard wood, pycnoxylic and manoxylic wood. Dendrochronology.

Unit IV

Defects of wood - Knots - Reaction wood - Compression and tension wood - Cross-grain - variation in log form - shake - pitch pocket - Drying crack and Logging injury. Defects in seasoning and machining of wood, Defects due to weathering - Defects of wood due to fungi and insects.

Unit V

Natural durability of wood - Wood preservation - Non-pressure processes - Pressure process - Chemical processing of wood - Commercial wood species and identification, Synthetic woods, Marine plywood, Fuel wood, pulp and paper making woods, matchstick wood. Economic importance of pulp and wood.

Books for Reference

- Brown *et al.* (1981). Textbook of Wood Technology. Tata McGraw-Hill, New Delhi.
- Brown, H. P. (1985). Manual of Indian Wood Technology. International Books and Periodicals Supply Service, New Delhi.
- Chowdhury, K. A. and Ghose, S.S., (1958). Indian Woods. Publication Division, Government of India, New Delhi.
- Franz, F. P., Kollmann and Wilfred A. Cote, Jr. (1968). Principles of Wood Science and Technology. Vol. I: Solid Wood. Springer-Verlag, New York.
- Franz, F. P. Kollmann (1988). Wood Science and Technology. Vol. I and II. Springer-Verlag, New York.
- Pearson and Brown (1984). Commercial Timbers of India. Government of India Publication, New Delhi.
- Tieuran, H. D. (1951). Wood Technology. Pituran Publishing Co., New York.
- Vaux, H. J. (1949). Textbook of Wood Technology. Vol. I. McGraw Hill, New York.
- Vaux, H. J. (1952). Textbook of Wood Technology. Vol. II. McGraw Hill, New York

| Semester | Subject Code | Title of the Paper | Hours of Teaching /Week | No. of Credits |
|-----------|--------------|---|-------------------------|----------------|
| IV | | Core Optional - Molecular Taxonomy and Phylogeny | - | - |

Objectives

- ❖ To know the microbial taxonomy
- ❖ To learn the biochemical and molecular taxonomy
- ❖ To know the molecular phylogeny of microbes

Unit I

Microbial Taxonomy- Introduction to microbial taxonomy – morphological taxonomy, biochemical taxonomy, and molecular taxonomy. Numerical taxonomy – basic concepts of taxonomy. Positive and negative aspects of each taxonomical methods. Morphological phylogeny.

Unit II

Biochemical & molecular taxonomy - Chemotaxonomy - fatty acid, protein finger printing , Isozyme typing, pigments & polyamines. Biochemical phylogeny. Molecular taxonomy -- G +C content, DNA – DNA hybridization, Plasmid profiles, RFLP, RAPD, STRR & LTRR, REP –PCR, rRNA based DNA finger printing methods.

Unit III

16S rRNA based finger printing - Types of rRNA - 23s rRNA, 16S rRNA & 5S rRNA. Importance of 16SrRNA in microbial identification and taxonomy. Methods of 16S rRNA / rDNA fingerprinting - Isolation of rRNA, RT- PCR, Isolation of DNA, amplification of 16S rDNA using PCR, Cloning, transformation, Blue-white screening, Plasmid isolation, Dot blot/Southern blot hybridization using specific probes Sequencing of 16S rDNA using chain-termination method.

Unit IV

Sequence analysis - Submission of rDNA sequences in GenBank–Bankkit & Sequin guidelines. NCBI, EMBL & DDBJ – retrieving sequences. RNA structure prediction, Restriction enzyme patterns. Ribosomal Database Project- Designing primers & probes. Sequence comparison, alignment and data base searching – ClastalW, FASTA & BLAST. DNA barcoding.

Unit V

Molecular phylogeny - Introduction to Molecular phylogeny – tree terminology, software programs for making phylogenetic trees–MEGA, Phylip, RAPDistance. Cladogram, additive trees and ultrametric trees, rooted, unrooted trees and tree shapes.

Books for Reference:

- Roderic, D.M. Page, Edward C.Holmes, (1998). Molecular Evolution: A Phylogenetic Approach. Blackwell publishing, USA.
- Primrose, S.B., (1998). Principles of Genome Analysis: A Guide to Mapping and Sequencing DNA from Different Organisms.
- Adolph, W., (1996). Microbial Genome Methods by Kenneth) Genome Mapping and Sequencing by Ian Dunham (Hardcover - Sep 1, 2003).
- Brendan Wren (Editor), Nick Dorrell (2002) Functional Microbial Genomics (Volume 33) (Methods in Microbiology), Academic Press, UK.
- Sandy B. Primrose Richard M. Twyman (2005) Principles of Genome Analysis and Genomics, Blackwell Publishing, USA.