

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	I	18BBO13C	CORE PAPER – I MICROBIOLOGY, MYCOLOGY, VIROLOGY AND PLANT PATHOLOGY	6

OBJECTIVES:

- To gain basic knowledge about microscopic living organisms and their characteristics
- To learn the techniques of handling micro organisms
- To acquire knowledge on the economic significance of Microbes

UNIT – I

Whittaker's five-kingdom classification. General characteristics of Bacteria. Classification of bacteria based on Morphological characteristics; Ultrastructure of bacterial cell, locomotion, Chemical composition of cell wall, Gram staining, Nutrition and growth of Bacteria: Nutritional types:- Photolithotrophic Autotrophy, Photoorganotrophic Heterotrophy, Chemolithotrophic Autotrophy, Chemoorganotrophic Heterotrophy. Modes of cell division; Growth curve and endospore formation.

UNIT - II

Sterilization techniques: Physical and Chemical, Culture techniques- Pure culture techniques; Pour plate method, Streak plate, Spread plate method. Normal growth curve in Batch culture; Impact of intrinsic and extrinsic factors on bacterial growth; Recombination – Transformation, Transduction and Conjugation. Economic importance of Bacteria.

Unit – III

Fungi – General characteristics of fungi; Classification (Alexopoulos and Mims, 1979); Structure, Reproduction and life cycle (excluding developmental stages) of *Albugo* sp., *Aspergillus* sp., *Neurospora* sp., *Saccharomyces* sp., *Penicillium* sp., *Puccinia* sp., *Peziza* sp., and *Colletotrichum* sp.,. Economic importance of fungi.

UNIT – IV

Mycoplasma – General outline of mycoplasma

Viruses – Morphology; structure, Types and Classification of viruses based on genetic material; Replication of Bacteriophages; adsorption, penetration, replication, assembly and release (Lytic and Lysogenic cycles). Plant virus- TMV and CaMV.

Unit – V

Plant Pathology: Introduction; Classification of plant diseases based on causal organisms; List of bacterial, fungal and viral diseases in plants. Study of the causative organisms, symptoms and control measures of the following diseases:

1. Tikka disease of groundnut (*Cercospora* sp.)
2. Citrus canker (*Xanthomonas* sp.)
3. Yellow vein mosaic disease of *Bhendi*
4. Mycoplasma disease (Little leaf of Brinjal)

PRACTICALS:

Microbiology:

1. Glassware handling and lab practices (Microscope handling).
2. Sterilization techniques & Types.
3. Preparation of Basal medium – solid agar and broth
4. Preparation of agar plates, agar slants and agar deep tubes.
5. Isolation and culturing techniques of microbes – streak plate and pour plate methods.
6. Simple staining of bacteria.
7. Gram's staining of bacteria.
8. Isolation of microorganism from air and water.
9. Assessing the milk quality by Methylene Blue Reductase Test (MBRT).

Mycology:

1. Whole mount of *Albugo*, *Puccinia*, *Neurospora* using cotton blue.
2. Study of morphology and anatomy of the genera as given in the syllabus.
3. Pathology- Observation of disease specimens as per syllabus.

REFERENCES:

1. Pelczar, M.J (Jr), Chan, E.C.S and Krieg, N. R (1986). Morphology. Tata Mc Graw Hill Publishing Company Ltd, New Delhi.
2. Scheigel, H. S (1986). General Microbiology, (6th edition). Cambridge University press, London.
3. Sharma, P.D. Microbiology (2nd edition). Rastogi Publication, Meerut.
4. Aneja, K. K. (1996). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation, Wishwa Prakashan, New Delhi.
5. Purohit, S. S. (1999) Microbiology Fundamentals and Applications, (6th Edition). Agrobios (India), Jodhpur.
6. Dubey and Mageshwari – Text Book of Microbiology. Schand & Co. Ltd.
7. Alexopoulos, C.J., Mims, C. W. and Blackwel, M. 1996. Introductory Mycology. John Wiley & Sons Inc.
8. Clifton, A. 1958. Introduction of bacteria. Mc Graw Hill Book Co., New York
9. Mandahar, C. L. 1978. Introduction to plant viruses. Chand & Co. Ltd, New Delhi
10. Rangaswamy, G and Mahadevan, A. 1999. Diseases of Crop plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi.
11. B. P. Pandey. Plant Pathology
12. A text book of Plant Pathology – A.V.S.S Sambamurthy, I.K. International Publishing House Pvt. Ltd, New Delhi.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	I	18BBO14A	ALLIED PAPER - I GENERAL BOTANY - PLANT DIVERSITY (For B. Sc. Zoology Students)	6

OBJECTIVES:

- To study the basics of plant diversity
- To acquire knowledge on the classical plant systematics through locally available families

Unit -I

A general classification of plant Kingdom. Algae - Structure and life cycle of the following genera: *Chlamydomonas*, *Dictyota* and *Polysiphonia*, *Anabaena*. Economic importance of Algae.

Unit - II

Fungi - Structure and life cycle of the following genera - *Albugo* and *Saccharomyces*. Economic importance of fungi. Bryophytes - Structure and life cycle of *Marchantia* and *Polytrichum*.

Unit - III

Pteridophytes - Structure and life history of the following genera: *Lycopodium*, *Adiantum*; Gymnosperms - Structure and life history of *Cycas*.

Unit - IV

Morphology: stem, leaf, inflorescence and flower (outline only); pollination mechanism; types of fruits and seeds. Dispersal of fruits and seeds. Seed germination - Epigeal (Bean) and Hypogeal germination (Paddy) and Vivipary (*Rhizophora*).

Unit - V

Taxonomy, Outlines classification of Bentham and Hooker's system; Taxonomic features, and economic importance of the following families; *Annonaceae*, *Cucurbitaceae*, *Acanthaceae*, *Lamiaceae*, *Amaranthaceae* and *Poaceae*.

PRACTICALS:

- Morphological and anatomical features of the genera of algae, fungi, byrophytes, pteridophytes and gymnosperms given in the syllabus.
- Morphology of fruits and seeds. Fruit and seed structures for dispersal. Types of germination in dicot and monocot seeds.
- Taxonomy of locally available plants belonging to the families mentioned in the syllabus.

REFERENCES:

1. A text book of ancillary Botany – Muneeswaran.
2. Outlines of Botany – Narayanasamy and K.N.Rao.
3. Botany for Degree students – Dutta.A.C
4. College Botany – Gangulee.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	I	18ENV1GE	ENVIRONMENTAL STUDIES (For all UG courses)	2

OBJECTIVES:

- To create awareness about the environment
- To understand the basic concepts of ecosystem and Biodiversity
- To create awareness about the hazards of pollution and their control measures
- To understand the various social issues and its remedies.

UNIT I:

Environment – Introduction – Nature- Scope – Content – Need for study. Natural resources- Forest and energy resources- Use and overexploitation- deforestation. Energy resources- renewable and non renewable energy resources.

UNIT II:

Ecosystem – concept – types- Forest, Grassland, Desert and Aquatic(Pond)- Structure and function of an ecosystem – Producers- consumers and decomposers – Food chain – food web- ecological pyramids- energy flow. Biodiversity and its conservation- *in situ* and *ex situ* conservation- Mega biodiversity centres and hotspots.

UNIT III:

Environmental pollution- definition- causes-effects and control measures of air, water, soil, thermal and nuclear pollutions. Waste management- Industrial and solid waste. Disaster management – earthquake, cyclone, flood and landslides.

UNIT IV:

Social Issues and the environment- Urbanization-Urban problems related to energy and watershed management. Environmental Ethics- Issues and possible solutions- Wasteland reclamation- Climate change- Global warming- Acid rain- Ozone layer depletion- Public awareness. Environmental laws- Environment Protection Act, Wildlife Protection Act, Forest Conservation Act.

UNIT V:

Human population and its impact on environment- Population growth- Resettlement and Rehabilitation of project affected persons- Case studies – Sardar Sarovar Project, Maharashtra and Bandipur National Park- Project Tiger, Karnataka, NTPC, India. Role of Indian and Global religions and Cultures in environmental conservation- Case study: sacred groves in Western Ghats (kavu) & Chinese culture. Human and Wildlife Conflicts.

Reference:

1. Bharucha. E, 2003. Text book of Environmental Studies, UGC New Delhi & Bharathi Vidyapeeth Institute of Environmental Education and Research, Pune- 361.
2. Arumugam. M & Kumaresan. V, 2016. Environmental Studies(Tamil version), Saras Publications, Nagerkoil.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	II	18BBO23C	CORE PAPER – II ALGOLOGY, BRYOLOGY AND LICHENOLOGY	4

OBJECTIVES:

- To understand the major groups of cryptogamic plants and their characteristics
- To trace the inter relationships and evolutionary trends in cryptogams
- To acquire knowledge on the economic significance of cryptogams

Algology:

Unit-I

A general account and classification of Alga (Smith, 1955) – distribution - range of thallus organization – pigmentation- flagellation- reserve food – Reproduction (vegetative-asexual-sexual), Life cycle patterns. Detailed study of structure, reproduction and life cycle of the following: *Anabaena*, *Chlamydomonas*, *Volvox*, *Caulerpa* and *Chara*.

Unit-II

Detailed study of structure, reproduction and life cycle of the following: *Diatom*, *Dictyota*, and *Polysiphonia*. Economic importance of algae. General account of fossil algae.

Bryology:

Unit-III

General characters and classification (Smith, 1965) of Bryophytes. Morphology, structure and reproduction of the following: *Marchantia* and *Porella*,

Unit – IV

Morphology, structure and reproduction of the following: *Anthoceros* and *Polytrichum*. Evolution of sporophyte and gametophyte; ecological aspects. Fossil bryophytes. Economic importance of Bryophytes.

Lichenology:

Unit – V

Lichens: Introduction, types, Occurrence, distribution, classification, external and internal structural organization, types of reproduction. Biological significances of Lichens. Economic importance of Lichens.

Practicals:

1. Study of morphology and anatomy of genera given in the syllabus (Algae and Bryophytes).
2. Types of lichens and Apothecium.
3. Study of economically important products obtained from Algae, Bryophytes and Lichens.

REFERENCES:

1. A Text Book of Botany Singh Pandey and Jain 4th Edition Rastogi Publications 2010.
2. College Botany Dr. B.P. Pandey 5th Edition S. Chand Co., Pvt. Ltd 2013.
3. College Botany, Gangulee and Kar Vol II. New Central Book Agency Pvt. Ltd 2007.
4. Kumar, H.D. 1988. Introductory Phycology. Affiliated East –West Press Ltd.,
5. Morris, I .1986.An Introduction to the algae .Cambridge University Press, UK.
6. Parihar, N .S.1991.Bryophyta .Central Book Depot, Allahabad.
7. Bryophytes. Puri, P.1980, Atma Ram & Sons .Delhi.
8. .The Biology of Algae, Round, F .E.1986,Cambridge University Press
9. The Structure and Reproduction of The Algae F.E. Fritich Vol I&II Vikas Publishing House Pvt. Ltd 1975.
10. Text Book of Algae O.P. Sharma .Tata McGraw Hill Publication 1986.
11. The Ecology of Algae F.E. Round Cambridge University Press.1981
12. Modern Approaches to The Taxonomy of Red and Brown Algae. Irvine and Price. Academic Press. INC 1978.
13. Algae B.S. Vashista S. Chand Co., Pvt. Ltd 1983.
14. The Blue Green Algae Fogg, Stewart, Fay & Walsby Academic Press INC 1973.
15. Text Book of Algae J.S. Gupta Oxford and IBH Publishing Co., 1981.
16. Bryophytes Vishista. S. Chand Co., Pvt. Ltd 1986.
17. Bryophytes O.P. Sharma Tata McGraw Hill Publication 2014.
18. Kumar, H.D. 1988. Introductory Phycology. Affiliated East –West Press Ltd.,
19. An Introduction to the algae. Morris, I .1986, Cambridge University Press, UK.
20. Bryophyta, Parihar, N .S.199, Central Book Depot, Allahabad.
21. Bryophytes, Puri, P.1980, Atma Ram & Sons .Delhi.
22. The Biology of Algae, Round, F .E.198, Cambridge University Press Cambridge.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	II	18BBO24C	CORE PAPER – III ECOLOGY AND PLANT GEOGRAPHY	4

OBJECTIVES:

- To understand the basic concepts of ecosystem and Biodiversity
- To create awareness about the hazards of pollution and their control measures
- To study the different types of vegetation in India

UNIT – I

Ecology: Scope and objectives. Individual, Triggering and Holistic impacts of climatic, edaphic and biotic factors on plant life. Community concepts, Succession. Methods of studying vegetation – Quadrats and transects. Population ecology, Ecophene, Ecotypes.

UNIT – II

Ecosystem – concept, structure, types and functions- energy flow and bio-geo chemical cycle- Nitrogen cycle, Phosphorus cycle and Water cycle. Ecosystem diversity – Hydric system – hydrophytic adaptations, Xeric systems – xerophytic adaptations and halophytic adaptations.

UNIT – III

Patterns in Plant biodiversity – Levels of biodiversity. Human impact on biodiversity. Social impact on plant diversity: Pollution - air, water, soil, Noise and radioactive pollution - Global warming, acid rain. Pollution disasters – Bhopal gas and Chernobyl tragedies. Pesticides and its impacts. Pollution law enforcement.

UNIT – IV

Conservation and types (*In situ* and *Ex situ* conservation). Red data list, Mega biodiversity centres in Tamilnadu, India and World. Hotspots. Chipko movement and Silent valley project.

UNIT – V

Plant geography and forestry: Principles of plant geography – Phytogeographical regions in India. Distribution types – continuous, discontinuous and endemic. Continental drift. Vegetation mapping, GIS and its application in forestry. Vegetation types - Rain forest, Deciduous forest, Mangrove forest and Scrub jungle. Minor forest produce. Agroforestry and Social forestry.

PRACTICALS:

- Practice to handle the instruments for measuring temperature (soil, air, water), moisture (rainfall, relative humidity, soil moisture), wind (velocity and direction) and light intensity.
- To study ecological adaptations in plants (hydrophytes - *Hydrilla* and xerophytes - *Nerium*)
- To determine minimum area of sampling unit (quadrat) for the study of plant community.
- To prepare maps of India with respect to (i) climatic zones (ii) forest types and (iii) phytogeographical regions and comment on it.
- Collection and submission of any 10 minor forest products.

SCIENTIFIC VISITS:

Visit to biosphere reserve, museum, national park or a sanctuary/mangrove vegetation/Botanical Survey of India/Forest Research Institutes.

REFERENCES:

1. A text book of Plant Ecology; R.S. Shukla and P.S. Chandel. 2007, 11th Edition. C. Chand and Company Ltd. New Delhi.
2. Environmental Biology; P.D. Sharma, 1994. Rastogi and Company, Meerut.
3. Modern concepts of Ecology; H.D. Kumar, 2007. 8th Edition, UBS Publisher's & Distributors Pvt. Ltd. New Delhi.
4. Manual of Plant Ecology; K.C. Misra, 1974. Oxford & IBH Publishig Co. New Delhi.
5. Basic Principles and concepts of Ecology; Part – I. 1980. P.D.Sharma & R.Mishra.
6. The Ecology of Natural Resources; I.G.Simmons. 1986. IInd Edition, ELBS.
7. Plant Ecology; A.K. Agarwal and P.P. Deo, 2006. Agrobios (India), New Delhi.
8. Environment and Plant Ecology; J.R. Etherington, 1976. Wiley Eastern Ltd., New Delhi.
9. Ecology and Environment; P.D. Sharma, 2009. 10th Edition, Rastogi Publications, New Delhi.
10. Basic Concepts of Ecology; Clifford B. Knight, 1971. The Macmillan Company Collier – Macmillan Ltd. London.
11. Plant Ecology; Weaver and Clements, 1966. TMH Publishing Company Ltd. Delhi.
12. A text book of Plant Ecology; R.S. Ambasht and N. K. Ambasht, 2011. CBS Publishers and Distributers Pvt. Ltd., New Delhi.
13. Concepts of Ecology; R.S. Verma and V.K. Agarwal, 1998. C. Chand and Company Ltd. New Delhi.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	II	18BBO25A	ALLIED PAPER - II PLANT STRUCTURE AND FUNCTIONS (For B. Sc. Zoology students)	6

OBJECTIVES:

- To study the basics of Plant cell & Plant tissues
- To gain preliminary knowledge on Plant Genetics & Breeding
- To acquire knowledge on the physiological aspects in plants and recent trends in Plant Biotechnology

Unit - I

Cytology - Ultra structure of plant cell. Structure and functions of chloroplast, mitochondria and nucleus.

Anatomy - Simple and complex tissues; Anatomy of stem, leaf and root of dicot and monocot plants: Normal secondary growth in dicot stem.

Unit - II

Embryology - Structure of mature anther and ovule. Fertilization (double fertilization and triple fusion). Structure, types and functions of endosperm. Structure of a mature dicot embryo (*Capsella bursa-pastoris*).

Genetics - Mendelism - Monohybrid and Dihybrid ratios - Laws of dominance, Segregation and Independent assortment.

Unit – III

Plant Breeding: Aim, Scope and Significance. Selection (Mass and pureline), Hybridization and Heterosis (Outline only). Plant

Biotechnology - Aim, Scope and Significance, introduction to Plant tissue culture and genetic engineering.

Unit - IV

Plant physiology –Absorption of water (active and passive). Types of transpiration. Stomatal movement. Photosynthesis: Light reaction and dark reaction (C₃ Cycle). Phytohormones – Auxins. Plant movements (phototropism and geotropism).

Unit - V

Ecology - Factors of Environment (Abiotic and Biotic Factors), Morphological and Anatomical adaptations of Hydrophytes (*Hydrilla*) and Xerophytes (*Nerium*)
Phytogeography- Vegetation types of India.

PRACTICALS:

Anatomy: Types of tissues, T.S of Young stem, Root and leaf of Dicot and Monocot plants.
Normal secondary structures of dicot stem.

Embryology: Structure of mature Anther, Ovule and dicot embryo (Observation only).

Physiology:

Demonstration of ascent of sap (ring experiment)

Demonstration of Ganong's Potometer

Demonstration of evolution of oxygen during photosynthesis

Ecology: Hydrophytes and Xerophytes. Vegetation types of India.

Genetics: Mono and Di-hybrid crosses.

Biotechnology: PTC- Callus, Genetic engineering - golden rice

REFERENCES:

1. A text book of ancillary Botany – Muneeswaran.
2. Outlines of Botany – Narayanasamy and K.N.Rao.
3. Botany for Degree students – Dutta.A.C
4. College Botany – Gangulee.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	II	18VAL2GE	VALUE EDUCATION – GANDHIAN THOUGHTS (For all UG courses)	-

UNIT - I

Birth and Parentage - Childhood - At the High school - Stealing and Atonement - Glimpses of Religion - Gandhi's choice - Experiments in Dietetics - Acquaintance with Religions - The Great Exhibition.

UNIT - II

The first case - Preparing for South Africa - same experiences - on the way to Pretoria - Coolie - Natal Indian Congress - Education of Children - Brahmacharya.

UNIT - III

Simple life - The Boer war - Sanitary Reform and Famine Relief - Lord Curzon's Darbar - A month with Gokhale - Experiments in Earth and water treatment - Indian opinion - Coolie Locations or Ghettoes - The Black plague.

UNIT - IV

The Magic spell of a Book - The Zulu Rebellion - The Birth of Satyagraha - More experiments in Dietetics - Kasturbai's Courage - Domestic Satyagraha- Fasting - Shanti Niketan - Woes of Third Class passengers.

UNIT - V

Kumbha mela - Lakshman Jhula - Founding of the Ashram - Abolition of Indentured Emigration - The Kheda Satyagraha - The Rowlatt Bills - Navajivan and young India - Congress Initiation - The Birth of Khadi.

Text Books:

1. M.K.GANDHI , The Story of My Experiments with Truth - An Autobiography Apple publishing International(P) Ltd, Chennai.

2.

. மகாத்மா காந்தியின் சுயசரிதை - சத்தியசோதனை தமிழாக்கம் -
-ரா.வேங்கடராஜ்*லு, நவஜீவன் பரசுராலயம், அகமதாபாத

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	III	18BBO33C	CORE PAPER – IV PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY	5

OBJECTIVES:

- To understand the characteristics of major groups of lower vascular plants
- To gain knowledge on the economic importance of lower vascular plants
- To learn about the different erstwhile plants and their remains

Pteridophytes:

UNIT- I

Pteridophytes - General characteristics, Classification (Reimer's System, 1954). A detailed study of the morphology and anatomy of the following genera –*Psilotum*, *Lycopodium*, *Selaginella*, Homospory, heterospory, seed habit

UNIT- II

A detailed study of structure, reproduction and life cycle of the following genera –*Equisetum*, *Adiantum* and *Marsilea*. Stellar evolution, apospory and apogamy, Economic importance of Pteridophytes.

UNIT- III

General characters of Gymnosperms, Classification (Sporne-1965), Morphology, structure, reproduction and life history of *Cycas*.

UNIT- IV

A detailed study of morphology, structure, reproduction and life cycle of *Pinus* and *Gnetum*. Economic Importance of gymnosperms.

Paleobotany:

UNIT- V

Geological time scale; fossils and fossilization- kinds of fossils-petrifaction, cast, impression and compression. Radiocarbon dating. Contribution of Prof. Birbal Sahni (brief outline). *Rhynia*, *Lepidocarpon*, *Lepidodendron*, *Stigmaria*, and *Williamsonia*. Living fossil – *Gingko biloba*.

PRACTICALS:

1. Study of morphology and anatomy of the genera *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Adiantum*, *Marsilea*, *Cycas*, *Pinus* and *Gnetum*.
2. Study of the fossil specimens *Rhynia*, *Lepidocarpon*, *Lepidodendron*, *Stigmaria*, and *Williamsonia*

REFERENCES:

1. Bhatnagar, S. P. and Moira, A. 1996. Gymnosperms. New age international Pvt. Ltd., New Delhi.
2. Sporne, K. R. - Morphology of Pteridophytes
3. Sharma, O. P. - Text book of Pteridophyta
4. Smith, G. M. - Cryptogamic Botany (Vol. II)
5. Vashista, P. C. - Pteridophyta
6. Vashista P. C.- Gymnosperms
7. Sporne, K. R. - Morphology of gymnosperms, 1965. Hutchinson univ. Asia Publishing House.
8. Arnold, C. A. - An Introduction to Paleobotany
9. Ganguly Dass and Dutta - College Botany
10. Narayanaswamy, K. N., Rao and Raman, A. 2000 - Outline of Botany
11. Pteridophyta (Vascular Cryptogams)
12. P. C. Vashista, A. K. Shina, Anil Kumar, 2010, S.Chand & Company New Delhi – 110055.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	III	18BBO35S	SKILL BASED SUBJECT – I BIOFERTILIZERS	3

OBJECTIVES:

- To fathom the importance of Biofertilizers
- To gain knowledge on the production technology of Biofertilizers

Unit - I

Biofertilizers - Definition and types, importance of biofertilizers in agriculture. Organic fertilizers – Farmyard manure, Composting using Effective Microbes and traditional green manure.

Unit- II

Characteristics of Biofertilizers: Symbiotic (*Rhizobium* and Mycorrhizae), *Nif* genes. Non Symbiotic (*Phosphobacteria*, *Azospirillum* and Potassium solubilizer)

Unit - III

. Production technology: Sterilization, Strain selection, growth, mass production of various Biofertilizers - *Rhizobium*, *Azospirillum*, *Phosphobacteria* and Potassium solubilizer. Microbial consortium

Unit - IV

Characteristic studies and Production technology: *Azolla*, Mycorrhizae, and Vermicompost.

Unit - V

Application technology: Standards, quality control and approvals, Seed and seedling treatments, soil application for both field and tree crops.

Practicals

- Demonstration of biofertilizers preparation techniques.

REFERENCES:

1. Subba Rao N S (1982). Biofertilizers in Agriculture 2nd Ed. Oxford 7 IBH Co. Pvt. Ltd.
2. Environment & soil Sciences Martin
3. Agriculture Microbiology-G Rangasamy
4. Microbiology – Michael J Pelezar, E.C.S. Chan and Noel. R. Krieg. 5th Edition 1993. Tata McGraw- Hill Edition

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	IV	18BBO43C	CORE PAPER – V ANATOMY, MICROTECHNIQUES AND WOOD TECHNOLOGY	5

OBJECTIVES:

- To learn about the types of plant tissues and functions
- To gain knowledge on the anatomical features in Dicots and Monocots
- To know the methods of Plant specimen preparation for histological studies
- To study the various botanical aspects of seeds

Anatomy

Unit – I

Cell wall: ultra structure; pits and their types; plasmodesmata; functions. Meristems– Characters and types – structure and function of apical meristems – root apex and shoot apex – theories of meristems. Structure and function of simple tissues– parenchyma, collenchyma, sclerenchyma.

Unit- II

Complex tissues- xylem, phloem. Types, structure and function of cambium. Primary structures of dicot root (*Vigna*), monocot root (*Maize*), dicot stem (*Tridax*), monocot stem (*Maize*), dicot leaf (*Tridax*) and monocot leaf (*Polyanthus*). Stomata – types. Hydathodes and its functions.

Unit – III

Secondary growth: normal secondary growth in dicot stem and root. Anomalous secondary growth in *Nyctanthes*, *Boerhaavia* and *Dracaena*. Nodal anatomy: unilacunar node (*Polyalthia*), trilacunar node (*Gynandropsis*) and multilacunar node (*Aralium*).

Unit – IV

Microtechniques – Introduction- plant material collection – Processing. Brief outline of Killing and fixation- Dehydration (butyl alcohol method), clearing (Xylol) and Infiltration (Paraffin wax method) - Embedding (wax) – Sectioning – Microtomes (Rotary). Staining- simple and double staining (Safranin-Fast Green) - Mounting (DPX).

Unit – V

Wood Technology: Dendrochronology – Definition, growth rings; classification of wood - heart wood and soft wood; properties of wood - physical, chemical and mechanical; durability of wood - wood seasoning and preservation; commercial wood species of India (Teak and Rose Wood); composite wood: adhesive – types and uses; engineered wood – veneers, ply wood, MDF, particle board

PRACTICALS:

1. Observation and identification of different types of tissues (slides).
2. Observation and study of internal structure of monocot (stem and root) and dicot (stem and root).
3. Observation and study of internal structure of monocot and dicot leaf (slides).
4. Observation and study of anomalous secondary growth in *Nyctanthus*.
5. Observation and study of nodal anatomy – unilacunar, trilacunar (slides).
6. Observation of stomatal types.
7. Preparation of double staining – Demonstration
8. Microtome - Demonstration
9. Observation of growth rings
10. Observation of Heart wood and soft wood
11. Observation of engineered woods - veneers, ply wood, MDF, particle board

REFERENCES:

1. Anatomy of seed plants –Katherine Esau. 2nd Edition 1965 Wiley New York.
2. Esau's Plant Anatomy: Meristems, Cells, and Tissue of the Plant Body, 3rd Edition Author R. F Suan E. Eichhorn. 2006.
3. Plant Anatomy –Fahn. A. 3rd Edition 1985. Pergamon Press New York.
4. Comparative Wood Anatomy –Carlquest, S. Springer Science. Publication. 2001
5. Anatomy of Seed Plant V. Singh P.C. Pande and D.K. Jain Rastogi Publications Meerut 1998.
6. College Botany Vol II. B.P Pandey S. Chand and CO., Ltd New Delhi 2011.
7. Plant Anatomy B.P. Pandey S. Chand and Co., Ltd., New Delhi 2009.
8. Plant Anatomy, 1996. M.S. Tayal., Rastogi Publications.
9. Essentials of Botanical Microtechnique, 2005. Toji Thomas, Apex Infotech Publishing Company, Chennai.
10. Manual of Indian Wood Technology, 1985, H. P. Brown, International Books and Periodicals Supply Service, New Delhi.
11. Plant Anatomy, 2006, Ray F. Evert, Wiley Interscience, Madison.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	IV	18BBO47S	SKILL BASED SUBJECT - II MUSHROOM CULTIVATION	3

OBJECTIVES:

- To gain knowledge on the types of Mushrooms
- To develop career oriented skills among students in mushroom cultivation

UNIT-I

Introduction: Classification and identification of edible and poisonous mushrooms. Nutritional and medicinal value of mushrooms. Economic importance of mushrooms.

UNIT-II

Morphology and characteristics of commonly cultivated edible mushrooms.

- Paddy straw mushroom (*Pleurotus* sp.)
- Button mushroom (*Agaricus bisporus*)
- Milky mushroom (*Calocybe indica*)

Life cycle of a common mushroom (*Agaricus*)

UNIT-III

Culture Technology: Mushroom cultivation: site selection and construction of mushroom shed, infrastructure facilities.

UNIT- IV

Mushroom mother stock culture; preparation of mother spawn and seed spawn; mass cultivation techniques for *Agaricus*, *Pleurotus* and *Calocybe* mushrooms.

UNIT-V

Post-harvest technology: Harvesting and marketing, Preservation and storage of mushrooms. Problems in mushroom cultivation-pest and diseases, weed moulds and their control. Delicious recipes of mushrooms (mushroom soups and pickle).

PRACTICALS:

1. Spawn production
2. Sterilization of substrates
3. Bed layering and seeding
4. Observing the yield of mushrooms
5. Preparation and preservation of mushroom pickle

Field visit: TNAU, Coimbatore

REFERENCES:**TEXT BOOK:**

1. Nita Bahl (1996), Handbook of mushrooms. Oxford and IBH publishing co.Ltd. New Delhi.
2. Kapoor, J.N. (1989) Mushroom cultivation, ICAR, New Delhi.

REFERENCE BOOKS:

1. Aneja, K.R. 1993. Experiments in microbiology, Plant pathology, Tissue culture and Mushroom cultivation. Wishwa Prakshan, Ne

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	V	18BBO51C	CORE PAPER-VI CELL AND MOLECULAR BIOLOGY	5

OBJECTIVES:

- To achieve knowledge on the frontiers of plant cell and its organelles
- To prospect the chemical nature of plant cell

UNIT-I

The cell: Historical background; Structure of the plant cell; comparative account of prokaryotic and eukaryotic cell. Cell Wall – chemical composition and functions; Plasma membrane – Structure, model (Fluid mosaic) and functions.

UNIT-II

Chloroplast – Structure, function and its significances. Mitochondria – Structure and functions; Ribosomes – Origin; Structure and functions; Structure and functions of Golgi apparatus, lysosomes, endoplasmic reticulum and peroxysomes.

UNIT-III

Nucleus – Structure; nuclear pores; nuclear lamella and nucleolus; Nucleic acids – chemical structure of DNA – Watson and Crick model, A, B and Z forms of DNA, denaturation and renaturation of DNA; Chromatin – nucleosome model; RNA – types; Metaphase chromosome – karyotypes and idiogram; Special type of chromosomes – Giant and lamp brush chromosomes.

UNIT – IV

Cell division and cell cycle – Phases of cell cycle, mitosis and meiosis: significance of various stages of cell division; cytokinesis. DNA replication – semi conservative model; Genetic code – properties; Protein synthesis - transcription and translation.

UNIT - V

Regulation of gene expression; Central Dogma of molecular biology, one gene - one polypeptide hypothesis. Gene expression in prokaryotes – Operon concept (lac operon and trp operon); Gene expression in eukaryotes – structure of mRNA gene. Post-transcriptional and translational processing.

PRACTICALS:

- Observation and study of ultrastructure of cell organelles (chart, slides, models & micrographs).
- Isolation of Chloroplast and Mitochondria using ultracentrifuge.
- Observation of different stages of mitosis in onion root tip squash preparation.
- Observation of the Scheme/ Photograph of Structure of DNA, tRNA, and mRNA, Transcription, Translation, 'Lac' operon, 'Trp' operon.

REFERENCES:

1. Freifelder, D. 1993. Essentials of Molecular Biology, Jones & Bartlett, Boston.
2. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
3. Elliott WH & Elliott, DC. 2005. Biochemistry and Molecular Biology, 3rd Ed. Oxford University, Oxford.
4. Watson, J.D. 1987. Molecular Biology of Gene. The Benjamin. Gummings publishing co. inc. California
5. Hopkins, W. 1988. Molecular biology of the gene. Benjamin publishing Company. California.
6. Geoffrey m. Cooper, Robert, E. Hansman. 2007. The cell- A Molecular approach, sinauer Associates. USA.
7. Lee, P. J. 1999. Plant Biochemistry and Molecular Biology, 2nd edition. John Wiley and Sons, New York.
8. Gupta, P. K. 1999. A Text – book of Cell and Molecular Biology. Rastogi Publications, Meerut, India.
9. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular cell biology (4th Edition). W.H. Freeman and Co. New York, USA.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	V	18BBO52C	CORE PAPER-VII MORPHOLOGY, EMBRYOLOGY OF ANGIOSPERMS AND SEED TECHNOLOGY	5

OBJECTIVES:

- To observe and understand the external organization of angiosperms
- To gain knowledge on reproduction in angiosperms
- To know the potential and significance of seeds

UNIT- I

Vegetative morphology: The plant body (Angiosperm) - Duration and habit -roots-stems-buds- leaves and their modifications. Inflorescence- types.

UNIT – II

Floral morphology – Flower as a modified shoot. Floral parts- Patterns of floral symmetry - fusion of floral parts, carpel versus pistil insertion types. Placentation. Fruits and seeds.

UNIT – III

Embryology of Angiosperms: Structure and development of microsporangium – Microsporogenesis- Microgametogenesis – Pollen wall features. Scope of palynology. Megasporangium – Types of ovule, nucellus, integument- Obturator – caruncle- Hypostase and epistase.

UNIT – IV

Megasporogenesis and megagametogenesis. Development of female gametophyte, types - monosporic (*Polygonum*), Bisporic (*Allium*), tetrasporic (*Peperomia*). Pollination types and agents. Fertilization- Double fertilization and triple fusion . Endosperm types. Aleurone tissue. Embryogeny – Dicot (*Capsella*) and Monocot (*Najas*). Outlines of polyembryony.

Unit –V

Seed Technology

Amphimixis – Scope, Aim and importance of seed technology, structure of seed and seed coat; Seed germination and factors affecting germination, Vivipary, Seed dormancy and its types; Orthodox and recalcitrant seeds. Seed dispersal – types; seed viability – Tetrazolium test; overview of seed collection, processing, storage and seed certification.

PRACTICALS:

1. Observation of taxonomically significant root modifications (Beet root, Carrot)
2. Observation of taxonomically significant stem modifications (*Coccinia*, Ginger)
3. Observation of taxonomically significant leaf modifications (*Gloriosa*,)
4. Observation of taxonomically significant inflorescence types (Capitulum, Verticillaster)
5. Fruits – fleshy (Berry), Dry - dehiscent (*Calotropis*) and indehiscent (Samara)
6. Seeds – endospermous and non endospermous
7. Observation and study of T.S of young anther.
8. Observation of ovule types (slides).
9. Observation of embryo sac structure (chart).
10. Dissection of dicot embryo - *Tridax* (any one stage).
11. Study of endosperm types (slide).
12. Testing of seed viability –Tetrazolium salt test.

REFERENCES:

1. College Botany Vol. I. B.P. Pandey. S. Chand and Co., Ltd. New Delhi. 2011
2. Systematic Botany Bharathi Bhattacharyya 2009. Narosa Publishing House. India.
3. Modern Plant Taxonomy Dr. N.S. Subrahmanyam Vikas Publishing House Pvt. Ltd New Delhi.
4. Introduction to Taxonomy of Angiosperms 2011 B.K. Verma PHI Learning Pvt. Ltd New Delhi.
5. Taxonomy of Angiosperms V. Singh, Dr. V. Singh & Dr. D.K. Jain Second Edition 2010. Rastogi Publications Meerut India.
6. Advanced Morphology of Angiosperms. Akhil Baruah. 2008. Pointer Publishers.
7. Plant Morphology. 2011. Suniti Sharan. Pacific Books International.
8. Practical Manual of Plant Morphology. 203. S. Sundararajan. Anmol Publishers and Distributors.
9. Embryology of Angiosperms- S.S. Bhojwani and Bhatnagar, S, P.Vikas Publishing House Pvt Ltd., 2009.
10. An Introduction to embryology of angiosperm-P. Maheswari 1963. McCraw-Hill., New York.
11. Principles of Seed Technology 1995. Agarwal. II nd Edition Oxford and IBH Publications Pvt. Ltd. New Delhi India.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	V	18BBO53C	CORE PAPER-VIII PLANT SYSTEMATICS, ECONOMIC BOTANY AND ETHNOBOTANY	5

OBJECTIVES:

- To grasp knowledge on the classical taxonomic parameters of Angiosperms
- To comprehend the socio-economic prospective of locally available angiospermic families

Unit – I

Scope and importance of Taxonomy. Classification of Angiosperms- Bentham and Hooker system. Cronquist. Flora, revision and Monographs. Botanical nomenclature (ICBN), Taxonomic hierarchy, typification, principles of priority, publication, Keys and their types, Preparation and role of Herbarium. Importance of Botanical gardens.

Unit- II

Systematics and economic importance of the following families: Magnoliaceae, Sterculiaceae, Rutaceae, Anacardiaceae, Myrtaceae, Cucurbitaceae and Apiaceae,

Unit – III

Systematics and economic importance of the following families: Rubiaceae, Asteraceae. Apocynaceae, Solanaceae, Acanthaceae, Verbenaceae, Lamiaceae.

Unit – IV

Systematics and economic importance of the following families: Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae and Poaceae.

Unit – V

Economic Botany: Binomials, Family, Morphology of useful parts and uses of the following commercially important plants. Cereal (Paddy). Timber (Red Sander), Pulse (Green gram), Oil yielding plant (coconut), Spices (*Cinnamon*), Fiber (Cotton), Beverage (Coffee). Medicinal Plant (*Phyllanthus amarus*). Paper and pulp (*Casuarina*).

Ethnobotany: Brief outline of ethnobotany. Medicinal practices of Irulas.

PRACTICALS:

1. Taxonomy: Taxonomic study of plants belonging to the families as per the syllabus.
2. Field visits: Botanical study tour for 3 or 4 days to be undertaken for covering various natural habitats and one or two single day collection trips in South India.
3. Submission of 20 herbarium sheets (weeds) along with tour/trip report and field note book.
4. Economic Botany: Study of the morphology and structure of useful parts of the plants mentioned in and herbarium sheets and collection of samples of plants.
5. Ethnobotany: Listing of the medicinal practices of Irulas.

REFERENCES:

1. Plant Taxonomy O.P. Sharma.2007 Data McGraw-Hill Publishing Company New Delhi.
2. Introduction to Taxonomy of Angiosperms 2011 B.K. Verma PHI Learning Pvt. Ltd New Delhi.
3. Taxonomy of Angiosperms V. Singh, Dr. V. Singh & Dr. D.K. Jain Second Edition 2010. Rastogi Publications Meerut India.
4. Plant Systematics 2004. Singh Oxford & IBH Publishing Co., Pvt., Ltd. New Delhi.
5. Advanced plant Taxonomy A.K. Mondal. New Central Agency Pvt. Ltd., 2009. New Delhi.
6. College Botany Vol. I. B.P. Pandey. S. Chand and Co., Ltd. New Delhi. 2011
7. Systematic Botany Bharathi Bhattacharyya 2009. Narosa Publishing House. India.
8. Modern Plant Taxonomy Dr. N.S. Subrahmanyam Vikas Publishing House Pvt. Ltd New Delhi
9. Economic Botany – Pandey, B.P. and Anita. S. Chand and Co., Ltd. New Delhi. 2009.
10. Economic Botany of the Tropics – Kochar, S.L. (2000). Macmillan India Pvt. Ltd.
11. The useful Plants of India – CSIR Publications (1986) and Information Directorate, New Delhi.
12. Economic Botany – Sharma (1996) Tata McGraw Hill Co., Ltd.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	V	18BBO54C	CORE PAPER - IX GENETICS, PLANT BREEDING, EVOLUTION AND BIOSTATISTICS	5

OBJECTIVES:

- To study the basics principles of hereditary mechanisms in plants
- To understand the basics of breeding techniques in plants
- To learn the measures for validity and reliability of Botanical research

UNIT –I

Mendel's Experiments and Principles of inheritance, Law of Segregation, Law of Independent assortment, Law of Dominance, back cross and test cross; Gene interaction: Allelic interaction (Incomplete dominance), Complementary factor. Non allelic interaction (Dominant epistasis); Linkage and crossing over (Brief outline only), Chromosome mapping.

UNIT-II

Variation in chromosome structure (Duplication, Deletion, Inversion and Translocation); Variation in chromosome number: Euploidy- Autopolyploidy and Allopolyploidy, Aneuploidy- Trisomics, Monosomics and Nullisomics. Mutation (Spontaneous and induced mutations), Physical and chemical mutagens, Molecular basis of mutation.

UNIT-III

Extra-Chromosomal inheritance: Cytoplasmic male sterility (*Acetabularia*) and Plastid inheritance (*Mirabilis*); Sex determination in plants. Population Genetics: Gene frequency, Hardy- Weinberg's Law, Factors affecting Hardy- Weinberg Equilibrium.

UNIT-IV

Plant Breeding: Selection (Mass, Pure line and clonal selection), Hybridization- Types, Selection of parents, Methods of Emasculation- Bagging and tagging. Heterosis in crop improvement. Breeding achievements in Rice.

Evolution: Origin of Life, Evidences for organic evolution; Theories of organic evolution (Darwinism, Lamarckism & Mutation Theory).

UNIT-V

Biostatistics: General concepts and Terminology, Data-types (Primary and Secondary Data), Data collection, Sampling methods, Frequency distribution, Tabulation-General rules for Tabulation, Parts of Tables and Types of Tables, Diagrammatic and Graphic representation of Data. Analysis of Data-Measures of Central tendency (Mean, Median and Mode), Measures of Dispersion (Range, Standard Deviation and Standard Error), Test of Significance: Chi-square test.

PRACTICALS:

Genetics & Plant breeding:

- Chromosomal mapping
- Simple problems on the following aspects: Monohybrid cross, Test cross, Incomplete dominance and Dominant epistasis.
- Hybridization techniques using potted plants.

Biostatistics:

- Data analysis to determine Mean & Mode
- Finding out Standard Deviation by giving Data from plant sources
- Chi-square test

REFERENCE BOOKS:

1. Principles of Genetics – Eighth edition - Gardner, Simmons and Snustad (1991) John Wiley & Sons, Inc., Newyork.
2. Cytogenetics, Evolution and Plant Breeding- R.S. SHUKLA and P.S.CHANDEL (1988) S.Chand & Company (Pvt) Ltd, New Delhi.
3. A Textbook of Cytology, Genetics and Evolution-Third edition -P.K. GUPTA (1979) Rastogi Publications, Meerut, India.
4. Fundamentals of Cytogenetics and Genetics- Mahabal Ram (2010) PHI Learning Private Limited, New Delhi.
5. Genetics: Classical to Modern-First Edition- P.K.Gupta, (2007) Rastogi Publications, Meerut , India.
6. Principles of Genetics- S.B. Basu M. Hossain (2006), Books & Allied (P) Ltd, Kolkata.
7. Introduction to Biostatistics and Research Methods- Fourth Edition- P.S.S. Sundar Rao J.Richard, (2004) Prentice-Hall of India, New Delhi.
8. Fundamentals of Biostatistics- First Edition- Irfan A. Khan & Atiya Khanum, (1994) Ukaaz Publications, Hyderabad, Andhra Pradesh, India.
9. Organic Evolution -12th Revised Edition- Dr. Veer Bala Rastogi (2007) Kedar Nath Ram Nath, Meerut, New Delhi.
10. Biostatistics: Principles and Practice - B. Antonisamy, Solomon Christopher and P. Prasanna Samuel (2010) Tata McGraw Hill Education Private Limited, New Delhi.
11. Principles and Practice of Plant Breeding- J R Sharma (1994) Tata McGraw Hill Publishing Company Limited, New Delhi.
12. Principles of Biostatistics – Second Edition -Marcello Pagano, Kimberlee Gauvreau (2008) Cengage Learning India Private Limited, New Delhi.
13. Origin, Evolution and Adaptation- Sanjib Chattopadhyay (2007) Books and Allied (P) Ltd, Calcutta.
14. Essential Genetics - Second Edition- Peter J Russell (1987) Blackwell Scientific Publications, London.
15. Cytogenetics ,Evolution, Biostatistics and Plant Breeding - First Edition – R.A Shukla and P.S Chandel (2009) S.Chand & Company Ltd, New Delhi.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	V	18BBO56S	SKILL BASED SUBJECT – III HORTICULTURE	3

OBJECTIVES:

- To study the basics of plant propagation
- To expose students to the art of gardening and to inculcate the entrepreneurial skill in horticulture

Unit – I

Horticulture – Definition, branches and importance, Media – vermiculite, compost and soil mixture, coir pith. Growing structures- pots and glass house; Garden implements and accessories. Public gardens. Aesthetic gardens and indoor gardens.

Unit –II

Gardening – Landscape gardening, Lawn, Rockery, Bonsai, Water garden, cut flowers and Icabana. Topiary, vertical garden. Nursery layouts. Hydroponics, Terrace garden, Kitchen gardening.

Unit –III

Irrigation – Types of irrigation, Training – central leader and Kiffin system. Mulching, Pruning – Notching, disbudding and thinning; Cutting – root, wood and leaf cutting. Layering – simple, mound and air layering. Grafting – approach and tongue grafting. Budding –‘T’ budding and ring budding.

Unit –IV

Pomology – Cultivation of Mango and grapes. Floriculture – Cultivation of Rose and Orchid, Olericulture – Cultivation of brinjal and Bhendi (Lady’s finger).

Unit –V

Plant Production and storage: Cultural and mechanical methods, pest control management. Harvesting, Grading, and Packing. Storage – Refrigerated storage, controlled atmosphere storage (CAS) and marketing.

PRACTICALS:

- Learning the methods of macro propagation, techniques of layering, different methods of cutting and grafting.
- Field trips to Botanical gardens.

REFERENCES:

1. Ornamental Horticulture – Vishnu Sworup
2. Introduction to Horticulture – Kumar. N
3. Home Gardening – Trivedi
4. Horticulture – Manibhussan Rao
5. Fundamentals of Horticulture – Hatmann and Kestr.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	V	18BBO5EL	NON MAJOR ELECTIVE PAPER - I PLANTS AND HUMAN WELFARE- I	3

OBJECTIVES:

- To expose the students about the importance and advantages of Biofertilizers
- To learn the basic production techniques of microbial fertilizers
- To create awareness on the ecological significance of Biopesticides

Unit I

Biofertilizers – Definition, kinds of microbes as biofertilizers, Rhizobium-legume Symbiotic association – mass cultivation and carrier materials.

Unit II

Cultural methods of Azospirillum, Azotobacter, Azolla, Anabaena and carrier materials.

Unit III

Mycorrhiza – ectomycorrhiza, endomycorrhiza, VAM association, types, isolation and inoculum production.

Unit IV

Pesticides – Introduction – Biological Magnification concept. Biopesticides – Viral origin, fungal origin

Unit V

Biopesticides – Bacterial origin-*Bacillus thuringiensis*- mechanism of action and applications. Advantages of Biopesticides and Commercialization of biopesticides.

REFERENCES:

1. Subba Rao, N.S. 2000 Soil Microbiology. Oxford and IBH Publishing Co. Ltd.
2. Verma A and Hock B. 1995. Mycorrhiza. ISBN
3. Yaacovokan, 1994 - Axospirillum, CBC press.
4. Wicklow, D.T. and B.E. Soderstrom. 1997, Environmental and microbial relationships.. Springer ISBN

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	VI	18BBO61C	CORE PAPER - X PLANT PHYSIOLOGY	6

OBJECTIVES:

- To study the basics of plant physiological processes in plants
- To learn the physiological phenomenon of growth in plants
- To obtain knowledge on the role of phytohormones in agriculture.

Unit - I

Plant-Water relations: Importance of water; diffusion and osmosis; absorption; Transport of water, ascent of sap. Transpiration. Physiology of stomatal movement; Passive and active solute transport; source –sink relationship; factors affecting translocation.

Unit-II

Photosynthesis: Definition and its significance; photosynthetic apparatus and pigments, action spectra and enhancement effects; concept of two photosystems; Cyclic and non-cyclic photophosphorylation; Mechanism of CO₂ fixation in Calvin (C₃ cycle), C₄ and CAM plants; Factors affecting photosynthesis. Photorespiration.

Unit-III

Respiration – Definition, aerobic and anaerobic respiration; Glycolysis, Krebs' cycle; electron transport mechanism; oxidative phosphorylation and ATP synthesis; ATP - the biological energy currency; pentose phosphate pathway.

Unit-IV

Mineral nutrition: Essential micro and macro elements and their role, mineral uptake, deficiency and toxicity symptoms. Nitrogen metabolism: Biology of nitrogen fixation – *nif* genes – mechanism of nitrogen fixation and assimilation of ammonia.

Unit-V

Different phases of growth and development; plant movements (tactic and tropic); the concept of photoperiodism. Physiology of flowering: florigen concept: vernalization, biological clocks: physiology of senescence, fruit ripening; Plant hormones and its physiological role- Auxins, Gibberellins, Cytokinins, Abscissic acid and Ethylene, role of phytohormones in agriculture. Photomorphogenesis: cytochromes and phytochromes.

PRACTICALS:

1. Determination of osmotic pressure.
2. Factors affecting permeability of membrane.
3. Determination of rate of transpiration,
4. Separation of chloroplast pigments by paper chromatography.
5. Determination of rate of photosynthesis under variable CO₂ concentrations.
6. Determination of rate of photosynthesis under various light intensities.
7. Measurement of respiration (Ganong's respiroscope).
8. Determination of water absorption/transpiration ratio.

REFERENCES:

1. Hopkins, W.G (1995) Introduction to Plant Physiology. John Wiley & Sons Inc. New York, USA.
2. Salisbury, F.B and Ross, C.W. 1992. Plant Physiology (4th Edition) Wadsworth Publishing Co. California, USA.
3. Devlin and Witham, F.H. 1999. Plant Physiology. 4th Edition, CBS Publishers and Distributors, New Delhi.
4. Noggle, G.R. and Fritz, G.J. 2010. Introductory Plant Physiology. 2nd Prentice Hall of India, New Delhi.
5. Kochhar, P.L and Krishnamurthy, H.N. 1989. Plant Physiology. Atmaram & Sons, New Delhi.
6. Jain, V.K. 1995. Fundamentals of Plant Physiology. S. Chand & Co. New Delhi.
7. Verma, S.K. 1995. A Textbook of Plant Physiology and Biochemistry. Chand & Company Ltd, New Delhi.
8. Mukherji S and A.K. Ghosh. 1996. Plant Physiology. Tata McGraw Hill Publishing Company Ltd, New Delhi.
9. Subhash Chandra Datta. 1994. Plant Physiology. Wiley Eastern Ltd, New Delhi.
10. Sinha, R.K. -2007, Modern Plant Physiology, Narosa Publishing House, New Delhi.

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Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	VI	18BBO62C	CORE PAPER – XI PLANT BIOCHEMISTRY	5

OBJECTIVES:

- To understand the basic concepts of chemical environment of a cell
- To obtain knowledge on the different biomolecules in plant cells

Unit- I

Cellular Chemistry: Covalent and non-covalent interactions; hydrogen bond; electrostatic interactions; hydrophobic interactions; Van der Waals forces and their significance.

Unit - II

pH and buffers: pH and its significance; pH scale; Henderson-Hasselbalch equation; isoelectric point; buffers (inorganic and organic) and their importance; ATP – the energy currency;

Energy flow: Laws of thermodynamics; concept of free energy; energy transfer and redox potential.

Unit – III

Enzymes: Structure, nomenclature, Modern classification and mechanism of enzyme action, factors affecting enzyme activity.

Carbohydrates: Classification (brief outline), structure of glucose, sucrose, starch and cellulose.

Unit – IV

Amino acid and Proteins: Structure and classification of amino acids; peptide bond; polypeptide chain; structure of proteins – primary, secondary, tertiary and quaternary.

Lipids: Classification (brief outline), difference between saturated and unsaturated fatty acids; fatty acid biosynthesis and β – oxidation of fatty acids.

Unit – V

Vitamins: General properties and classification of vitamins. Sources and deficiency symptoms of vitamins.

Secondary metabolites: An outline of secondary metabolism – alkaloids, terpenoids, polyphenols and volatile oils.

PRACTICALS:

1. Preparation of buffers – phosphate and citrate buffer
2. Determination of pH of any two soil samples
3. Determination of pH of lemon and watermelon
4. Qualitative test for carbohydrates, amino acid and proteins.
5. Estimation of carbohydrate by colorimetric method (Anthrone reagent method)
6. Estimation of total free amino acids by ninhydrin reagent method
7. Estimation of total protein by Lowry's method.

REFERENCES:

1. Conn, E. & Stumpf, P.K., 1979. Outline of Biochemistry, Niley Easdtern Ltd., New Delhi.
2. Stryer, L. 1995. Biochemistry, Fourth edition. W.H. Free Man & Company New York.
3. Lehninger, A.L. 2005. Biochemistry V edition, Kalyani Publishers, Ludhiana.
4. Jain, J.L., 1999. Fundamentals of Biochemistry. S.Chand & Co. Ltd., New Delhi.
5. Nelson, D.L. and Cox, M.M. 2000. Lehninger – Principles of Biochemistry. Worth Publishers, New York.
6. Devlin TM. (ed.), 2006. Text book of Biochemistry, 6th Ed. A John Wiley & Sons, Inc. Publication, New York.
7. Wilson, K. and Walker, J. 2000. Practical Biochem- Principles and Techniques. Cambridge Uni. Press, Cambridge, U.K.
8. Das Gupta, S.K. 1977. Biochemistry Vol.II, Macmillan & Co., New Delhi.
9. Berg JM, Tymoczko JL & L Stryer. 2006. Biochemistry, 6th edition, W.H. Freeman and Company, New York.
10. Elliott WH & Elliott DC. 2005. Biochemistry and Molecular Biology, 3rd Ed. Oxford University, Oxford.
11. Metz, E.T., 1960. Elements of Biochemistry, V.F & S (P) Ltd., Bombay.
12. Renganatha Rao, K., 1986. Text Book of Biochemistry, Prentice-Hall of India (P) Ltd., New Delhi.
13. Saim, A.S., 1994. Text Book of Biochemistry, CBS Publishers, New Delhi.
14. Zubay, G.L., Pason, W.W. and Vane, D.E. 1995. Principles of Biochemistry W.W.C Brown Publishers, Oxford.
15. Lea, P.J and Leegood, R.C. 2001. Plant Biochemistry and Molecular Biology, 2nd Ed. John Wiley and Sons Ltd. England.
16. Weil, J. H. 1997. General Biochemistry. New Age International Ltd., New Delhi.
17. Voet, D and Voet, J.H. 1995. Biochemistry. John Wiley and Sons, New York.
18. Marry.K.Campbell. Shawn O. Fawell. 2007. Biochemistry. 6th Ed. Thompson.Brooks/cole.USA
19. Reginald.H.Garrett, Charles M. Grisham. 2010. Biochemistry. Mary Fimch Publisher. Boston. USA.
20. McKee and J.R. McKee, 1996. Biochemistry and introduction. Won C. Brown publishers, London.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	VI	18BBO63C	CORE PAPER XII BIOTECHNOLOGY AND BIOINFORMATICS	5

OBJECTIVES:

- To study the different avenues in the field of Plant Biotechnology
- To learn the basic techniques in cloning of plants for desirable traits
- To obtain knowledge on the fundamentals of computer software in biology

Unit - I

Biotechnology-Basic concepts. Genetic engineering enzymes and tools. Vectors-Plasmid vectors, bacteriophage vectors (λ). Gene transfer strategy. Screening of recombinants – Blue-white selection, colony hybridization. DNA probes and Blotting techniques- Western and Southern blotting.

Unit - II

Genetic Engineering in plants: aim and scope for developing transgenic plant – *Agrobacterium* mediated gene transfer techniques to develop disease resistant and stress tolerant plants, *Bt* cotton, golden rice and variegated banana. Direct transformation methods. Pros and cons of GM crops.

Unit- III

Industrial production of organic acid (Citric acid), Amino acid (Glutamic acid). Biodegradable plastics, Biopesticides- *Bacillus thuringensis*. Design of fermentor (STR).

Unit - IV

Bioinformatics: Fundamentals of computer hardware components, software types- operating system software (Windows and UNIX) and programme software (BioPEARL), Internet-browser, HTML, Databases, Data mining and Data retrieval.

Unit - V

DNA sequence databases (EMBL, GenBank and DDBJ), Sequence file formats, Sequence alignment – local and global -Pair wise and multiple sequence analysis, BLAST implications, Gene identification and prediction. Proteomics: Protein sequence databases (SWISS PROT and PDB), Protein visualization tools (Rasmol) - Protein structure prediction - Homology modeling of protein (Swiss pdb Viewer).

PRACTICALS:

1. Isolation of DNA from bacteria (Demonstration)
2. Isolation of DNA from plant tissue (Demonstration)
3. Amplification of DNA through PCR (Demonstration)
4. Windows and UNIX operating system.
5. Content and file structure study of GenBank, DDBJ, PDB, SWISSPROT.
6. Multiple sequence alignment using Clustal X and phylogenetic tree construction.
7. Molecular visualization using Rasmol.

REFERENCES:

1. Bioinformatics: Methods and applications – S. C Rastogi, N. Mandiratta and P, Rastogi, PHI New Delhi.
2. Bioinformatics: Principles and applications – Z. Ghosh and B. Mallick, OUP, New Delhi
3. Elements of Biotechnology – P. K. Gupta, Rastogi publications, Meerut
4. Biotechnology – Sathyanarayana, NCB, Calcutta.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	VI	18BBO66S	SKILL BASED SUBJECT – IV PLANT TISSUE CULTURE	3

OBJECTIVES:

- To create awareness among students about *in vitro* propagation of plants
- To enable the students to enrich their skills in plant tissue cultural techniques.

Unit – I

Introductory history, Laboratory organization, Culture Media (MS medium), Aseptic Techniques.

Unit –II

Micropropagation – Direct and Indirect (Callus culture, Nodal culture, Meristem culture, Shoot tip culture), Somaclonal variation, Suspension culture.

Unit –III

Haploid culture – Anther culture, pollen culture and ovary culture - Triploid production.

Unit –IV

Isolation and culture of protoplast, Somatic Hybridization, Somatic Embryogenesis, Artificial seed production.

Unit –V

Production of secondary metabolites – alkaloids, steroids, and terpenoids (Brief account only). Cryopreservation and germplasm preservation.

PRACTICALS:

1. Sterilization techniques (Fumigation, Flame sterilization, Dry heat, Wet heat and Filter sterilization)
2. MS Medium preparation
3. Callus culture
4. Nodal culture
5. Artificial Seed production

REFERENCES:

1. Plant Cell and Tissue Culture – Narayanasamy, S. Tata Mc- Graw- Hill Publishing & Co Ltd
2. Plant Cell, Tissue and Organ Culture – Edited by J. Renert and Y.P.S.Bajaj, Narosa Publishing House New Delhi First Reprint 1989.
3. An Introduction to Plant Tissue Culture – Razdan, M.K.
4. Biotechnology- U Sathyanarayana Books and Allied (P) Ltd, (2005).

5. Text Book of Biotechnology – Dubey. R .C S. Chand &Co New Delhi, First Edition 1993.
6. Biotechnology – Kumaresan, V.
7. Concept of Biotechnology - Balasubramanian *et al.* University Press.
8. Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom production, Aneja. K.P. (2001), New Age International (P) Ltd. New Delhi.
9. Elements of Biotechnology – P.K Gupta. Rastogi Publication (Revised Second Edition 2009-2010), New Delhi.
10. A Laboratory Manual Plant Biotechnology – S.S.Purohit (2006), Agrobios (India), Jodhpur.
11. Plant Biotechnology Practical Manual- C.C.Giri and Archana Giri (2007), I.K. International Publishing House Pvt. Ltd. New Delhi.

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2018 -2019 onwards	VI	18BBO6EL	NON MAJOR ELECTIVE PAPER - II PLANTS AND HUMAN WELFARE- II	3

OBJECTIVES:

- To study the basics of plant propagation methods
- To expose students to the art of gardening and to inculcate the entrepreneurial skill in horticulture

Unit -I

Horticulture :- Importance and scope of Horticulture, Classification of horticultural crops – fruits, vegetables crops, climate, soil, water, nutrition needs of horticultural crops,

Unit- II

Plant propagation methods, cutting, layering, grafting, budding, stock-scion relationship. Use of plant regulators in horticulture.

Unit -III

Garden designs, types of gardens – formal, informal and kitchen garden, units of garden, hedge, border, topiary, arches and lawn maintenance.

Unit -IV

Green house, shade house, Indoor gardening – Bonsai – flower arrangements- fresh and dry flower – Ikebana. Nursery management and maintenance.

Unit -V

Floriculture, cultivation of commercial flowers – rose and jasmine. Olericulture – cultivation of Brinjal and cucumber. Cultivation of important fruit trees – Mango and Banana.

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2. Sandhu, M.K. (1989) : plant Propagation Wiley Eastern Ltd.,New Delhi, Bangalore, Bombay, Calcutta, Madras, Hyderabad, Pune-287pp.,
3. Lex Lauries & Victor H. Rice- (1950) : Floriculture – fundamental and practices. McGraw Hill Publishers,
4. N.Y. Kumar , N. (1997) : Introduction to Horticulture Rajalakshmi Publications, Nagercoil, India- (28 Chapters & approx. 300pages)
5. Naik () South Indian Fruits and their culture Vardhachary & Co., Madras.
6. Edmond Musser & Andres () : Fundamentals of Horticulture McGraw Hill Book Co., Gardener () : Basic Horticulture Mac Millan,
7. N.Y. Randhawa () : Ornamental Horticulture in India Today & Tomorrow Publishers, New Delhi
8. Sundararajan, J.S. Muthuswamy, J. () : A guide to horticulture
9. Shanmugavelu, K.G. Balakrishnan, R. Thiruvankadam Printers, Coimbatore.