

SEMESTER – I
Core Paper - I
MICROBES AND INDUSTRY

Instructional Hrs. 75

Sub. Code: 16BOPC101

Max.Marks: CIA 25; ESE -75

Credits: 4

Objectives: To study the Classification - Characteristics & Structure of industrially important microbes. To study the isolation - Identification & Production of potential microbes in industries. To develop the skill of manufacturing industrial products.

UNIT - I

15 Hrs.

Bacteria - Classification of Bacteria (Bergey's, 1923) – Morphology and Ultra structure – Bacterial culture and cultural characteristics – Isolation and maintenance of pure culture – Growth curve of bacterial population - Quantitative measurement of bacterial growth – *Economic importance of bacteria*.

UNIT - II

15 Hrs.

Viruses - History of Viruses - Classification (Harrison *et al.*, 1971) – Structure of Virus - Double strand RNA and DNA viruses - Cauliflower Mosaic Virus – Wound Tumour Virus – Bacteriophages – Morphology – structure and replication – *HIV/AIDS Virus*.

UNIT - III

15 Hrs.

Industrial microbiology - Scope of industrial microbiology - Development of industrial fermentation process – Screening - Detection and assay of fermentation products - Stock culture - Fermentation media - Inoculum preparation- Scale up of fermentations - *Increasing product yield*.

UNIT - IV

15 Hrs.

Fermentation techniques – Types of Fermentation – Importance of microbial enzymes in industry – Industrial production of cellulolytic enzymes – Penicillin – Glutamic acid – Citric acid and *Vitamin B₁₂*.

UNIT - V

15 Hrs.

Microbiology of soil and water – Rhizosphere and Mycorrhizae – factors affecting microbial community in soil. Types of water – Fresh water microbiology – *Purification of water*.

Note: Bold and Italics denote self study topics.

Practicals:

Microbiology

1. Inoculation of fungi and bacteria on selected media and maintenance of cultures.
2. Isolation of soil microbes (Bacteria and fungi) by dilution plating method using selective media.
3. Knowledge on anti-bacterial activity by using antibiotics.
4. Gram's staining
5. Test for coliform
6. Microbial screening – Photographs
7. SCP production - Photographs

REFERENCES:

1. **Agarwal, A.K. and Parihar, P.**, "*Industrial Microbiology*", Shriya Computers and Printers, Jodhpur, 2006.
2. **Casida, L.E.**, "*Industrial microbiology*", Wiley Eastern Ltd., New Delhi, 1968.
3. **Chawla, D.S.**, "*Food feed and fuel from Biomass*", IBH, New Delhi, 1991.
4. **Patel, A.H.**, "*Industrial Microbiology*", Mac Millan India Ltd. New Delhi, 1984.
5. **Paul, A. Ketchum**, "*Microbiology*", John Wiley & Sons, USA., 1968.
6. **Pelczar, M.J. (Jr.)**, **Chan, E.C.S.** and **Kreig, N.R.**, "*Microbiology*", Tata, Mc Graw Hill, New Delhi, 3rd Edition, 1993.
7. **Purohit, S.S.**, "*Microbiology - Microbiology Fundamentals and Applications*", Saraswathi, Purohit for Students Press, India, 2003.
8. **Michael, Pelczar, J.**, **Chan Jr. E.C.S.** and **Krief, N.R.**, "*Microbiology*", Tata Mc Graw- Hill, New Delhi, 3rd edition, 1995.
9. **Smith, K.M.**, "*Viruses*", Cambridge University Press, 1974.

SEMESTER – I
Core Paper – II
PHYCOLOGY, BRYOLOGY AND LICHENOLOGY

Instructional Hrs.: 75

Max. Marks: CIA 25; ESE -75

Sub. Code: 16BOPC102

Credits:4

Objectives: To understand the Range of thallus – Structure - Reproduction methods and life cycle pattern of lower plants and to understand the role of Lichens in human welfare.

UNIT - I

15 Hrs.

ALGAE : Classification of Algae (Fritsch, 1945)- **Phylogeny and interrelationship** - Range of thallus – **Pigmentation** - Reproduction and life cycle patterns of **Chlorophyceae** and **Bacillariophyceae**

UNIT - II

15 Hrs.

Comparative study of the range of structure – reproduction and life cycle pattern of - **Phaeophyceae- Rhodophyceae – Cyanophyceae** - Phylogeny and inter relationship- **Economic importance of Algae.**

UNIT - III

15 Hrs.

BRYOPHYTES: Classification (Reimer's ,1954) Origin– Distribution – Structure – Reproduction and life cycle of **Hepaticae** – Takakiales – Calobryales – Jungermanniales – Metzgeriales – Sphaerocarpaceae - Monocleales and **Marchantiales.**

UNIT - IV

15 Hrs.

Distribution – structure - reproduction and life cycle of **Anthocerotae** – Anthocerotales; **Bryopsida** - Sphagnales - Andreaeales – Funariales - Polytrichales – Fossil Bryophytes - **Economic importance .**

UNIT - V

15 Hrs.

LICHENS : Classification of Lichens (Hale, 1969) - Origin and evolution of lichens. Occurrence and Inter-relationship of Phycobionts and Mycobionts- Structure and Reproduction in Ascolichens- Basidiolichens and Deuterolichens- Lichens as indicators of Pollution- **Economic importance of Lichens.**

Note: Bold and Italics denote self study topics.

Practicals :

Phycology: Gonium - Pediastrum – Hydrodictyon- Ulva - Bulbochaete – Cladophora - Pithophora –Stigeoclonium – Draparnaldia – Trentepohlia - Zygnema – Closterium – Nitella - Pinnularia – Sargassum - Padina – Turbenaria – Batrachospermum – Ceramium – Amphiroa - Gracillaria and Gelidium – Oscillatoria - Gloeocapsa – Lyngbya.

Bryology: Riccia - Targionia - Lunularia – Reboulia – Dumortiera - Aneura - Sphagnum and Bryum.

Lichenology: Parmelia, Usnea

REFERENCES:

1. **Bold, H.C., and Wyne, H.J.,** *“Introduction to the Algal structure and reproduction”*, Prentice Hall, Engle wood Cliffs, New Jersey, 1978.
2. **Chapman, V.J. and Chapman, P.J.,** *“The algae”*, The English language book society and Macmillan Publications, 1973.
3. **Fritsch, F.E.,** *“Structure and reproduction of the Algae”*. Vol. I, II & III, 1935-1945.
4. **Lee, R.E.,** *“Phycology”*, Cambridge University Publications, London,1987.
5. **Parihar, N.S.,** *“An introduction to bryophytes”* Vol. III. Central book Depot. Allhabad, 1967.
6. **Vashishta, B.R., Sinha, A.K. and Adarshkumar,** *“Botany for degree students – Bryophyta”*, S. Chand & Company Ltd., New Delhi, Revised Edition, 2008. 8.
7. **Frank Cavers** .The Inter Relationships of the Bryophyta, S.R.Technico Book house.1981
8. **Watson E.V.,** The Structure and life of Bryophytes. Hutchinson University Library, London, 1971.
9. **Prempuri,** Bryophytes; Morphology Growth and Differentiation. Atma Ram and Sons, 1986.
10. **Foster, A. S. and Gifford, E. M.** Comparative Morphology of Vascular Plants W.H. Freeman and Co.1973.

SEMESTER – I

Core Paper – III

MYCOLOGY AND PHYTOPATHOLOGY

Instructional Hrs.:75

Sub. Code:16BOPC103

Max. Marks: CIA 25; ESE -75

Credits:4

Objectives: To understand the range of thallus – Structure - Reproduction methods and life cycle pattern of Fungi and to understand plant – pathogen interaction

UNIT - I

15 Hrs.

FUNGI : Classification of fungi (Alexopoulos, 1962). Cell wall composition- mode of nutrition- Myxomycetes (Chytridiomycetes – Hypochytridiomycetes - Oomycetes - *Zygomycetes*).

UNIT - II

15 Hrs.

Range of Structure - Reproduction and Interrelationship of Ascomycetes (Hemiascomycetidae, Plectomycetidae, Hymenoascomycetidae and *Loculoascomycetidae*).

UNIT -III

15 Hrs.

Range of Structure - Reproduction and Interrelationship of Basidiomycetes and *Deuteromycetes*. Heterothallism - *Economic importance of fungi*.

UNIT IV

15 Hrs.

Plant Pathology: Classification of plant diseases – Principles of plant disease control - cultural, biological and chemical - Effect of environment on disease development. Causal organism, Symptoms, Disease cycle and control measures of little leaf of Brinjal, Black wart of Potato, *Blight of Paddy* and virus diseases of Potato.

UNIT V

15 Hrs.

Pathogenesis: Penetration and entry - Enzymes in plant disease – cell wall degrading enzyme. *Toxins*, Dissemination of Plant pathogens - Defense mechanism .

Note: Bold and Italics denote self study topics.

Practicals :

Mycology : Albugo – Saprolegnia – Rhizopus - Mucor – Saccharomyces – Ascobolus – Pezzia -
Puccinia - Agaricus – Polyporus-Lycoperdon-Alternaria-Fusarium-Cercospora

Phytopathology:

1. Estimation of total chlorophyll in infected and healthy plants.
2. Causal agent, symptoms and control measures of Black wart of Potato, little leaf of Brinjal, Blight of Paddy and Virus diseases of Potato.
3. Anatomical studies of infected regions.
4. Comparison between infected and healthy plants with reference to total carbohydrate and Protein.

REFERENCES:

1. **Alexopoulos, C.J.** and **Mims C.W.**, *“Introductory Mycology”*, Wiley Eastern PVT., LTD., New Delhi, Second Edition, 1962.
2. **Ainsworth, S.C., Sparrow, F.E.** and **Sussman, A.D.**, *“The fungi and advanced treatise”*, Vol. I, II, III, IVA & IVB.
3. **Vashishta, B.R., Sinha, A.K.**, *Fungi Botany for degree students.S. Chand & co, New Delhi, 2007.*
4. **Mehrotra, R.S and Aneja, K.R.** An introduction to Mycology. New age international Pvt.Ltd. Mumbai, 1998.
6. **Agrios, George, N.**, *“Plant Pathology”*, Academic Press, Sandiego, London. 1988.
7. **Aneja, K.R.**, *“Experiments in Microbiology, Plant Pathology and Tissue culture”*, Wishwa Prakashan, New Delhi, 1996.
8. **Baker, F and Cook, R.J.**, *“Biological control of plant pathology”*. Chand and Company LTD., New Delhi, 1979.
9. **Bilgrimi, K.S.** and **Dube, H.C.**, *“A text book of Modern Plant Pathology”*, Vikas Publishing House, PVT., LTD., Kanpur, 1980.
10. **Mehrotra, R.S.**, *“Plant Pathology”*, Tata Mc Graw Hill Publishing Company Ltd., New Delhi,1996.

SEMESTER – I
Core Paper – IV
PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY

Instructional Hrs: 75

Sub. Code: 16BOPC104

Max. Marks: CIA 25; ESE -75

Credits: 4

Objectives: To know gametophytic and sporophytic structural variations in Pteridophytes and Gymnosperms

UNIT - I

15 Hrs.

Classification of Pteridophytes (Reimer's, 1954) - Telome concept - Apospory - Morphology - anatomy and reproduction of - *Psilotales* - Selaginellales – Isoetales – Marattiales.

UNIT - II

15 Hrs.

Morphology - anatomy and reproduction of – Ophioglossales – Osmundales - Filicales – *Salviniales* - Sorus evolution.

UNIT - III

15

Hrs.

Classification of Gymnosperms (Sporne, 1965), General account of *Bennettitales* – *Pentoxylales* - *Cycadales* – Ginkgoales.

UNIT - IV

15

Hrs.

General account of Coniferales (Cupressaceae – Podocarpaceae – Araucariaceae - Pinaceae) Taxales - Gnetales - *Angiospermic characters*.

UNIT - V

15

Hrs.

Fossils: Types of fossils- process of fossilization and importance of fossils - Detailed study of the fossil forms – Pteridophytes- Rhynia- Lepidodendron – Calamites – Sphenophyllum – Gymnosperms - Lyginopteris - Cordaites.

Note: Bold and Italics denote self study topics.

Practicals :

Pteridophytes: Psilotum- Selaginella – Angiopteris – Osmunda – Dicranopteris – Lygodium – Pteris – Alsophila – Nephrolepis - Salvinia and Azolla.

Gymnosperms: Pinus, Gnetum, Cupressus – Podocarpus – Araucaria - Ephedra.

Fossils: Rhynia – Lepidodendron , Stigmaria, Sphenophyllum – Calamites.

Gymnosperms: Lyginopteris - Lagenostoma - Pentoxylon – Cordaites.

REFERENCES:

1. **Rashid.A. 2007.** An Introduction to Pteridophyta - Vikas publications, New Delhi.
2. **Sporne, K.R. (1975).** The Morphology of Pteridophytes, Hutchinsonand Co., London.
3. **Foster, A. S. and Gifford, E. M.** Comparative Morphology of Vascular Plants. W.H. Freeman and Co.1973.
4. **Johri, RM, Lata S, Tyagi K (2005),** A text book of Gymnosperms, DominatePub and Distributor, New Delhi.
5. **John M. Coulter and Chamberlin C.J.,** “ *Morphology of Gymnosperms*”, Central book Depot., Allahabad, 1917.
6. **Vasishta, P.C., Sinha,A.K. and Anilkumar,** Botany for Degree Students Gymnosperms.S.Chand & co, New Delhi. 2006.
7. **Chester A. Arnold,** “ *An introduction to Palaeobotany*”, Agrobios (India), Jodhpur, 1947.

SEMESTER – II
Core Paper –VI
CELL BIOLOGY AND TISSUE CULTURE

Instructional Hrs.:90

Max.Marks:CIA25;ESE-75

Sub. Code: 16BOPC206

Credits:4

Objectives: To comprehend the structure of cell organelles. To understand the structure and replication of nucleic acid .To develop the skill of in *vitro* propagation and application in horticulture and forestry.

UNIT- I

18 Hrs.

Cell Organelles- Cell-ultra structure - Cytoplasmic organelles - origin-structure and function of Mitochondria-Golgi apparatus- Plastids- Ribosome- Dictyosome - Glyoxysome and *Peroxisome*.

UNIT- II

18 Hrs.

Plasma membrane- Ultra Structure and functions. Cell wall- primary- secondary and tertiary at microscopic and submicroscopic levels. Chemistry of cell wall- Structure and functions of nucleus- nuclear envelope and *nucleolus*- Chromosomes – ultra structure and function, **specialized chromosomes-polytene and lamp brush** .

UNIT- III

18 Hrs.

Cell divisions- Mitosis- mitotic apparatus and its significance. *Meiosis and its significance*. DNA – Structure (Watson and Crick model) - replication - termination of replication -Role of Enzymes in DNA replication - Methylation and Repair mechanism. Types of DNA - Mitochondrial and chloroplast DNA. Types and synthesis of RNA.

UNIT- IV

18 Hrs.

Tissue culture – Concepts and Applications – *Basic steps* (Preparation of media- sterilization – inoculation – incubation – regeneration - hardening and plantlet transfer) Type of cultures – callus and suspension culture Meristem culture, Protoplast isolation and culture - Hybrids and Cybrids- Somatic hybridization.

UNIT- V

18 Hrs.

Somaclonal variation- Somatic embryogenesis- Haploid production- and Embryo culture-Synthetic seed - Cryopreservation-Application of tissue culture in Agriculture- Horticulture and *Forestry*.

Note: **Bold** and *Italics* denote self study topics.

Practicals :

Cell biology

1. Study of meiosis using smears - Individual
2. Interpretation of micrographs from standard purchased materials or from transparencies.

Tissue Culture

Preparation of stock solution- sterilization- inoculation- nutrient media- organ culture- Morphogenesis- Induction of callus- Group Practical

Synthetic seed preparation - Individual

REFERENCES:

1. **Archana Sharma**, "*Chromosomes*", Oxford and IBH Publishing Company , 2nd Ed., 1985.
2. **Freifelder, D.**, "*Molecular Biology*", Narosa publishing house, New Delhi, 2nd Ed.,1983.
3. **Verma P.S. and Agarwal V. K.**, "*Cytology*", Chand and company Ltd., Publications, New Delhi,1978.
4. **Young, W.J.**, "*Cytogenetics*", Prentice Hall India, Pvt. Ltd. 2nd Ed., 1988.
5. **Watson, J.D. and Benjamin W.A.** , "*Molecular Biology of the genes*", 3rd Ed.
6. **De Robertis, E.D. P., Wiktor, W. Nowinski & Francisco A. Saez** "*Cell Biology*" W.B Saunders Company, London and Toppon Company Ltd., Japan.
7. **Kumar, N.C.**, "*An Introduction to Plant Tissue and Cell Culture*", Emkay Publications, New Delhi, 1994.
8. **Razdon, M.K.**, "*Introduction to plant tissue culture*", second Edition. Oxford IBH Publishing co. PVT., LTD., New Delhi,1995.
9. **Singh, Seema Srivastava**, "*Plant tissue culture*", Campus books International, New Delhi, 2006.

SEMESTER – II

Core Paper -VII

GENETICS, GERMPLASM CONSERVATION AND PLANT BREEDING

Instructional Hrs.: 90

Sub. Code: 16BOPC207

Max.Marks: CIA 25; ESE -75

Credits:4

Objectives: To discern the genetical disorders in life forms. To understand the regulation of gene expression. To know the hybridization methods and techniques in crop plants.

UNIT-

18Hrs.

Interaction of genes – Lethal factors- Modifying factors- collaborative factors. Co dominance - Quantitative inheritance - sex determination in plants- Theories of sex determination (theory of Heterogametic&Genic balance)-Sex limited characters- *Sex influenced characters*.

UNIT II

18Hrs.

Gene mutation - Detection of mutation (CLB Method - Muller 5 method). Physical and chemical mutagens and their mode of action. Eugenics- Euthenics- genetic disorder of chromosomal and genic origin. Extrachromosomal inheritance - Uniparental inheritance in Chlamydomonas and Yeast-*Male sterility in Maize*.

UNIT- III

18 Hrs.

Population genetics – gene frequency –Hardy Weinberg law, *Genetic drift*-Modern concept of genes- Structure of gene-IS Element and Transposons- Regulation of gene expression in Prokaryotes and Eukaryotes Artificial synthesis of gene.

UNIT -IV

18 Hrs.

Germplasm conservation- World diminishing plant resources-*Threatened and endangered plants*- Red Data Books- The role of IBPGR (Rome, Italy) and NBPGR (New Delhi) in Germplasm Conservation - Patent and Intellectual Property Rights (IPR).

UNIT- V

18 Hrs.

Plant breeding – Objectives, breeding methods in self-fertilized - cross fertilized and vegetatively propagated plants-Breeding plants for improving yield and quality and resistant to diseases- *Distant hybridization in Plant breeding*.

Note: Bold and Italics denote self study topics.

Practicals:**Solving Problems involving:**

1. Interactions of factors
2. Sex linked inheritance
3. Quantitative inheritance
4. Calculation of gene frequencies
5. Training in hybridization techniques

REFERENCES:

1. **Arnold, R.W.**, "*Principles of Plant Breeding*", John Willey & Sons, 1960.
2. **Gilber, N.W.**, "*Organellar Heredity*", Revan Press, New York, 1978.
3. **Gupta, P.K.**, "*Genetics*", Rastogi Publication, Meerut, India, 1994.
4. **King, R.C.**, "*A Hand book of Genetics*", Plenum Press, New York, 1994.
5. **Singh, B.D.**, "*Plant Breeding: Principles and Methods*", Kalyani Publishers, 2008.
6. **Singh, B.D.**, "*Genetics*", Kalyani Publishers, 2008.
7. **Swaminathan, M.S. and Jana. S.**, "*Biodiversity*", Mac Millan, India Press, Madras, 1992.
8. **Verma P. S. and Agarwal , V.K.**, *Genetics*, S. Chand & Co, New Delhi, 2006.

SEMESTER – III

Core Paper - VIII

TAXONOMY AND BIOSYSTEMATICS

Instructional Hrs.:75

Sub. Code:15BOPC308

Max.Marks: CIA 25;ESE -75

Credits:4

Objectives: To conserve the biodiversity. To identify the locally available plants. To understand the relationship of Taxonomy with other fields of Biological science.

UNIT I

15 Hrs.

Systems of classification- Artificial – Linnaeus - Natural – Bentham and Hooker Phylogenetic – Engler and Prantl - Modern – Cronquist – Merits and demerits. International Code of Botanical Nomenclature – Typification - Principles of priority and their limitations. Effective and valid publications - *citation*-retention - choice and rejection of names.

UNIT II

15 Hrs.

Flora: Monograph - Keys - *Botanic gardens* -Modern trends in Taxonomy-Anatomy-Embryology-Palynology- Cytology- Chemotaxonomy

UNIT III

15 Hrs.

Families-Systematic Position - Description and Economic uses of the following families Menispermaceae – Polygalaceae – Caryophyllaceae – Portulacaceae - Oxalidaceae – Meliaceae –Vitaceae – Rhamnaceae – Sapindaceae - **Fabaceae** – *Caesalpiniaceae* – Mimosaceae - **Rosaceae** – Onagraceae – Lythraceae - Aizoaceae.

UNIT IV

15 Hrs.

Oleaceae – Gentianaceae – Apocynaceae - Solanaceae – Boraginaceae – Bignoniaceae – Pedaliaceae - Nyctaginaceae – **Aristolochiaceae** - Loranthaceae - *Scitamineae* - Commelinaceae - Aroideae – Cyperaceae.

UNIT V

15 Hrs.

Biosystematics- Its aim and scope. Phenotypic plasticity. Turreson's work. Ecological differentiation- *Gene ecology*- Numerical taxonomy.

Note: *Italics denote Self Study Topics.*

Practicals

1. Study of the Taxonomical characters of the above mentioned families with economic importance
2. Preparation of artificial key
3. Submission of herbarium sheets – No. 50.
4. Field trip for 7 Days
5. Visit to BSI / Nilgiri Biosphere National Park

Reference Books

1. **Bennet, S.S.R.**, “*An Introduction to Plant Nomenclature*” International Book Distribution, India, 1989.
2. **Davis & Hey wood**, “*Principles of angiosperm taxonomy*” Today and Tomorrow’s Printers And Publishers, New Delhi, Revised Edition, 1965.
3. **Heslop J. Herrison**, “*New concepts in flowering plants taxonomy*”, Heinemann Educational Books, India, Revised Edition, 1970
4. **Lawrence H.M.**, “*Taxonomy of Vascular plants*”, Mac Millan & Co, New Delhi, 1979.
5. **Rendle A.R.**, “*A Classification of flowering plants*”, Vol. I and II., Cambridge University Press, 1979.
6. **Sokal S.R.** and **Sneath P.H.**, “*Principles of Numerical Taxonomy*”, N.H. Freeman & Co. 1977.
7. **Solbrig**, “*Principles and methods of plant Biosystematics*”, The Mac Millan Company, New Delhi, 1985.
8. **Stace Clive A.**, “*Plant Taxonomy and Biosystematics*”, Edward Arnold, London, Second Edition, 1989.
9. **Attwood, T.K.** and **Parry Smith, D.J.**, “*Introduction to Bioinformatics*”, Pearson Education Ltd., Fifth edition, New Delhi, 2003.

SEMESTER – III

Core Paper - IX

PLANT PHYSIOLOGY AND PHYTOCHEMISTRY

Instructional Hrs.:90

Sub. Code: 15BOPC309

Max.Marks: CIA 25; ESE -75

Credits:4

Objectives: To learn the metabolic and biochemical reactions in plants.

To understand the movement of water and solute.

To enhance the technical skill in fruit development and fruit ripening

UNIT I

18Hrs.

Water- Structure- Properties- Biological significance- Diffusion- Osmosis- Water potential and Imbibition. A General account of absorption and translocation of water- solutes and assimilates. *Transpiration* and stomatal mechanis- Enzyme: Classification-Properties and mechanism of enzyme action.

UNIT II

18 Hrs.

Photosynthesis- *Photosynthetic pigments*- Mechanism of Photosynthesis : Light reaction – two pigment systems. Electron carriers- photophosphorylation- Carbon fixation in C₃ and C₄ plants- CAM pathway. Photorespiration and glycolate- metabolism.

UNIT III

18 Hrs.

Respiration- Glycolysis- - Pyruvate metabolism. TCA cycle- Electron transport system coupled with Oxidative phosphorylation- Metabolism of Storage protein and fat to carbohydrates-HMP pathway

UNIT IV

18 Hrs.

Growth hormones-General account of Auxin- Gibberellins- Cytokinins- Ethylene - Abscissic acid. Senescence- Phytochrome- Photoperiodism- Vernalisation-*Biological clock*.

UNIT V

18 Hrs.

Biomolecules - Classification- structure and properties of carbohydrates- amino acids- proteins and lipids - secondary metabolites and antioxidant activity (outline only).

Note: *Italics* denote Self Study Topics.

Practicals

a. Plant Physiology

1. Preparation of Molar, Normal, ppm and Percent solutions
2. Determination of Osmotic Pressure (OP) of cell sap of given specimen (Rhoeo leaf)
3. Determination of Diffusion Pressure Deficit (DPD) with potato tuber.
4. Comparison of the rate of respiration in germinating seeds and flower buds using simple Respirometer.
5. Rate of photosynthesis under varying CO₂ concentrations in a water plant.
6. Effect of intensity of light on O₂ evolution during photosynthesis using Wilmott's bubble counter.
7. Determination of water absorption/transpiration ratio.
8. Calculation of stomatal index in upper and lower epidermal peelings and Calculate the percentage of leaf area of Mesophytic leaf
9. Measurement of Respiratory Quotient in germinating seeds.
10. Peroxidase Activity (pH and Temperature)

Demonstration Experiments

1. Nitrification by soil microorganisms.
2. Effect of GA₃ on amylase activity in cereals.
3. Effect of IAA on excised shoot/hypocotyl cuttings of legumes.
4. Hydrolysis of starch by amylase activity.
5. Demonstration of transpiration rate using simple Potometer

b) Bio-Chemistry

1. **pH** : Measure the pH of cell sap and soil solution.
2. **Buffer**: Preparation of phosphate and NaOH buffer.

3) Chromatography

I. Paper Chromatographic technique

Separation of leaf pigments

Separation of amino acids.

II. Thin layer chromatographic technique

Separation of leaf pigments

Separation of sugars

III. Column chromatographic technique to separate chloroplast / Flower pigments.

4) Qualitative and quantitative methods

- i) Extraction of plant material-cold percolation
- ii) Qualitative analysis of phytochemicals
- iii) Total free amino acids (Ninhydrin reagent method)
- iv) Proteins (Lowry *et al.* 1951 method.)
- v) Total soluble carbohydrates (Anthrone method)
- vi) Starch (Clegg's 1956)

Demonstration Experiments

- 1) Agarose gel Electrophoresis
- 2) Determination of absorption spectra of chlorophyll a and b with spectrophotometer
- 3) Extraction of plant materials using Soxhlet Apparatus

Separation of sugars

Reference Books

1. **Albert L. Lehninger**, "*Principles of Biochemistry*", CBS Publishers & Distributors, PVT Ltd., New Delhi, 1987.
2. **Frank B. Salisbury** and **Cleon W. Ross**, "*Plant Physiology*", CBS Publishers, New Delhi, 1974.
3. **Geoffrey Zubay**, "*Biochemistry*", Addison Wesley Publishing Company, Sydney, 1984.
4. **Jain, J.L.**, "*Fundamentals of Biochemistry*", S. Chand and Company PVT., LTD., New Delhi, 2002.
5. **Malcom S. Wilkins**, "*Advance Plant Physiology*", Longman Group UK LTD., England, 1987.
6. **Meirion Thomas, S., Ranson** and **Richardson J.A.**, "*Plant Physiology*", Longman group limited, London, 1973,
7. **Robert M. Devlin** and **Francis H. William**, "*Plant Physiology*", CBS Publishers & Distributors, New Delhi, 1972.

SEMESTER – III

Core Paper - X

BIOINFORMATICS

Instructional Hrs.:75

Sub. Code: I5BOPC310

Max.Marks:CIA 25; ESE -75

Credits:4

Objectives: To acquire the skill on computer architecture.

To analyse the structure and sequence of biomolecules using New technology.

UNIT I

15 Hrs.

Introduction to internet-Usage of World Wide Web through Internet Explorer - e- mail server - internet server-URL -HTML - HTTP- FTP - Scope - Fields related to Bioinformatics- Application of Bioinformatics - Human genome.

UNIT II

15 Hrs.

Molecular biology- General account of Nucleic acid – structure and chemistry of DNA- RNA- Genes - gene Expression-Genetic code- Protein synthesis.

UNIT III

15 Hrs.

Introduction to Data base - Biological data bases- Objectives of Biological Databases- Types – Sequence data bases- NCBI – EMBL - DDBJ - Swiss Prot. PIR-PRF - Structural data bases – PDB - *Carbohydrate database* - Literature databases - Pub Med - Agricola.

UNIT IV

15 Hrs.

Sequence Analysis- Sequence alignment - Global and local alignment - Multiple sequence alignment. Multiple sequence alignment tools. Phylogenetic analysis - *Construction of phylogenetic tree* and its uses.

UNIT V

15 Hrs.

Gene finding- Proteomics (general account) - Protein secondary structure prediction - *Data mining* - Drug designing –Pharmacogenomic - *Biomolecular Visualization tools*.

Note: *Italics* denote Self Study Topics

Practicals

Spotters

1. Gene prediction using genemark-Algorithm
2. DNA Data Bank
3. Proteins- Secondary structure prediction- Algorithm
4. Literature Database – Pub Med
5. Sequence Alignment

Reference Books

1. **Andreas, D., Baxevanis, and B.F., Francis,** “*Ouellette Bioinformatics*”, John Wiley Sons Inc., PVT., LTD., Singapore, 2002.
2. **Arthur M. Lesk.,** “*Introduction to Bioinformatics*”, Oxford University Press, New York, 2003.
3. **Baxevanis and Quellette,** “*A Practical guide to analysis of genes and proteins*”, 1998.
4. **Mani, L. and Vijayaraj,** “*Bioinformatics for beginners*”, Kalai Kathir Achagam, Coimbatore, 2002.
5. **Smart M. Brown,** “*A biologist’s guide to bio computing and the internet*” 2000..
6. **Sundar Rajan, S. and Balaji, R.,** “*Introduction to Bioinformatics*”, Himalaya Publishing House, Mumbai, 2002.
7. **Rajadurai, M.,** “*Bioinformatics*”, PBS Book Enterprises, Chennai, 2010.
8. **Kumaresan, V.** “*Biotechnology*”, Saras publication Revised Edition, 2010.
9. **Shanmugavel, P. & Wadhwa G.,** “*Practicals in Bioinformatics*”, Pointer Publishers, Jaipur, India, 2009.

SEMESTER – IV

Core Paper - XI

GENETIC ENGINEERING AND BIOTECHNOLOGY

Instructional Hrs.:90

Sub.

Code:15BOPC411

Max.Marks:100

CIA25;ESE-75

Credits:4

Objectives: To understand the transgenic technology in plants.

To study the microbial production of organic acids and organic manure.

UNIT I

18 Hrs.

Genetic Engineering- Concepts of genetic engineering – Scope, Molecular Tools for genetic engineering- Cloning vectors (Out line)-Methods of Gene cloning –Polymerase Chain Reaction - Gene Libraries - Application of Genetic engineering.

UNIT II

18 Hrs.

Gene transfer methods- Nif- Hup- Nod genes- Transgenic plants—Transgenic plants as Bioreactor- DNA sequencing methods

UNIT III

18 Hrs.

Molecular markers and its application- DNA finger printing- Genetic counselling-. Gene therapy, Bone marrow transplantation, methods of gene drug delivery, Recombinant DNA Vaccine, Biochips

UNIT IV

18 Hrs.

Biotechnology and Environmental Protection: Biomining – Bioleaching- removal of metals from water- microbial enhancement of oil recovery. Biomass & Bioenergy-source, Bio Gas, BioHydrogen , Petrochemical Plants

UNIT V

18 Hrs.

Bioremediation & Bio degradation –Types of Bioremediation- Bio degradation of Xenobiotics – Genetically engineered organisms in biodegradation- Bioremediation in soil- Phytoremediation- Global environmental problems and sustainability through Biotechnology- Benefits and ethics of Biotechnology- Patenting Biotechnology inventions.

Note: *Italics* denote Self Study Topics.

Practicals

1. PCR techniques
2. DNA Isolation
3. Biological waste treatment

Spotters

1. Nitrogen fixing genes
- 2 Plasmid
3. Transgenic plants
- 4 Bioleaching

Reference Books

1. **Callow, A.J., Ford Lloyd, B.V. and New bury, H.J.**, "*Biotechnology and Plant Genetic Resources Conversation and Use*", CAB international, Oxon, UK.,1997.
2. **Dubey, R.C.**, "*A Text book of Biotechnology*", S. Chand & Company, 1999.
3. **Glazer, A.N. and Nikaid, H.**, "*Microbial Biotechnology*", W.H. Freeman & Company, New York, USA, 1995.
4. **Gupta, P.K.**, "*Elements of Biotechnology*", Rastogi Publication, 1998.
5. **Ignacimuthu, S.**, "*Basic Biotechnology*", Tata Mc Graw Hill Publishing Company Ltd. , Madras, 1985.
6. **Kartha, K.K.**, "*Cryopreservation of plant cells and organs*", CRC Press, Boca Raton, Florida, USA., 1985.
7. **Santharam, S.**, and **Montgomery, J.F.**, "*Biotechnology- Biosafety and Biodiversity*", Oxford and IBH Publishing Co., New Delhi,1999.
8. **Kumar, H.D.**, "*Modern Concepts of Biotechnology*", Vikas publishing house Pvt. Ltd., 2001.

SEMESTER - IV

Core Paper - XII

ECOLOGY AND CONSERVATION BIOLOGY

Instructional Hrs.:75

Sub. Code:15BOPC412

Max.Marks: CIA 25; ESE -75

Credits:4

Objectives: To create Awareness on environmental protection. To study the concept of biotic communities. To conserve biodiversity for future generation.

UNIT I

15 Hrs.

Ecosystem- Structure and function - Types - Autecology - Population ecology- Synecology- Communities - classification - **structure**.

UNIT II

15 Hrs.

Plant Succession- Causes of succession - Climax concept - Types of succession – Hydrosere – Xerosere - Biogeochemical cycles - Hydrological cycle - **Nitrogen** - **oxygen** – Sulphur – Carbon - Phosphorus - **chromium cycle**.

UNIT III

15 Hrs.

Environmental pollution- Types – Soil – Water – Air - Radiation and Noise Pollution- *Green house effect* - Global warming - **Impact of Pollution on vegetation – Ecological indicators**.

UNIT IV

15 Hrs.

Natural Resources- Types – Depletion – Conservation – Sustainable use. Role of Government in Environmental Protection – Awareness Programmes – Ecolabelling- Disaster management and Rehabilitation. *Theme Days for Environmental Awareness: World Environmental day, World Wetlands day, World Forestry day, World Water day, International day for Biological Diversity*

UNIT V

15 Hrs.

Biodiversity- **Importance – Degeneration** – Conservation - *In situ* (Biosphere reserves - National park - Sanctuaries) - *Ex situ* (Zoological and Botanical gardens) - Deforestation and *Social Forestry*- **Man – Wild life conflicts – Causes – Remedial measures**.

Note: *Italics* denote self study topics.

Practicals

1. Determination of Linear changes in vegetation by using line and belt transect methods.
2. Determination of frequency- density- abundance- dominance index. Similarity Index & Diversity Index by using quadrat frame.
3. Estimation of total biomass and herbage yield by harvest method.
4. Description of Zonation in pond and stratification in forest
5. Soil and water
 - i) Garden soil experiment to know texture.
 - ii) pH of the soil
 - iii) Water analysis for dissolved oxygen and CO₂

Reference Books

1. **Ambast, R.S.**, "*A text book of plant ecology.*" Students, Friends & Co., Varanasi, 1988.
2. **Asthana, D.K. and Meera Asthana**, "*A Text book of Environmental studies.*" S. Chand & Co. New Delhi, 2006.
3. **Bhatia, A.L. and Kohli, K.S.**, "*Environmental Biology.*" Ramesh book depot, Jaipur, New Delhi, 2005.
4. **Prabhu,P.C., Udayasoorian, C. and Balasubramanian, G.** "*An Introduction to Ecology and Environmental Science*" Avinash Paperbacks, Delhi, 2009.
5. **Mohan.P.Arora**, Ecology, Himalaya Publishing House, 2006.
6. **Babar,Md.** "*Environmental changes- Natural Disasters*".New India Publishing Agencies, New Delhi, 2007.
7. **Pandey, S.N. and Misra, S.P.** "*Environment and Ecology*, Ane Book Pvt. Ltd., New Delhi, 2011.

SEMESTER – IV
Core Paper - XIII
RESEARCH METHODOLOGY

Instructional Hrs.:75

Sub. Code: 15BOPC413

Max.Marks: CIA 25; ESE -75

Credits:4

Objectives: To know the methods and usage of instruments. To study the methods of writing research articles.

UNIT I

15 Hrs.

Lab techniques- Principles, methodology and uses of Spectroscopy - Infrared, Visible and NMR. Electrophoresis - Agarose gel - *Blotting techniques*-Microscopy -SEM-TEM and **Fluorescent - Chromatography - GLC and HPTLC.**

UNIT II

15 Hrs.

Lab techniques- Extraction – isolation – characterization, identification and quantification of secondary metabolites- Alkaloid- Flavonoids- Terpenoids and *Glycosides*.

UNIT III

15 Hrs.

Biostatistics- Collection of data – Primary data – Secondary data. Presentation of data - Tabulation graph. *Measures of central tendency - Mean (only arithmetic)- median and mode.* Measures of dispersion – Range - Standard deviation- Standard error. Probability – Theorems of probability. Student's't' Test. chi-square test - Analysis of variance (ANOVA) - (Theory only)

UNIT IV

15 Hrs.

Research Methodology - Characteristics of research - Objectives of research - Classification of research - Research Process - Research Problems –and -Criteria for selecting research problem - Steps in selecting research problem – **Review of literature – Components and purpose , Journal article – web Browsing.**

UNIT V

15 Hrs.

Interpretation and Report writing – Steps in writing report- layout of the report - Types of report - *Mechanics of writing.* **Manuscript for publication and proof correction. Citation index, impact factor, h – index and plagiarism.**

Note: *Italics* denote Self Study Topics.

Practicals

Spotters

1. Principles and working mechanism of Spectrophotometer, Blotting Techniques, SEM, TEM, GLC, HPTLC
2. Problems in Mean, Median, Mode, Standard Deviation, Standard Error, Student 't' test, Chi-square test.

Reference Books

1. **Kothari, C.R.**, *“Research Methodology – Methods and Techniques”*, New Age International Publishers, 2011.
2. **Zar, J.K.**, *“Biostatistical analysis”*, Prentice-Hall International, INC, Englewood cliffs, New Jersey, 1984.
3. **Vijay upagade and Arvind Shende.**, *Research Methodology*, S. Chand & Co., New Delhi, 2010.
4. **Veerakumari, L**, *Bio instrumentation*, MJP Publishers, Chennai, 2009.
5. **Kaur, H.**, *Instrumental methods of chemical analysis*, Pragati Prakashan, Meerut, 2001.
6. **Saravanavel, P.**, *Research Methodology*, Kitav mahal, New Delhi, 2010.
7. **Misra, R.P.**, *Research Methodology- A Hand Book*, Concept Publ. Company, New Delhi, 2000.
- 8.. **Rama Krishnan, P**, *“Biostatistics”* Saras Publications, Nagercoil, First Edition, 2001.

SEMESTER – III

Core Paper - VIII

TAXONOMY AND BIOSYSTEMATICS

Instructional Hrs.:75

Sub. Code:15BOPC308

Max.Marks: CIA 25;ESE -75

Credits:4

Objectives: To conserve the biodiversity. To identify the locally available plants. To understand the relationship of Taxonomy with other fields of Biological science.

UNIT I

15 Hrs.

Systems of classification- Artificial – Linnaeus - Natural – Bentham and Hooker Phylogenetic – Engler and Prantl - Modern – Cronquist – Merits and demerits. International Code of Botanical Nomenclature – Typification - Principles of priority and their limitations. Effective and valid publications - *citation-retention* - choice and rejection of names.

UNIT II

15 Hrs.

Flora: Monograph - Keys - *Botanic gardens* -Modern trends in Taxonomy-Anatomy-Embryology-Palynology- Cytology- Chemotaxonomy

UNIT III

15 Hrs.

Families-Systematic Position - Description and Economic uses of the following families Menispermaceae – Polygalaceae – Caryophyllaceae – Portulacaceae - Oxalidaceae – Meliaceae –Vitaceae – Rhamnaceae – Sapindaceae - **Fabaceae** – *Caesalpinaceae* – Mimosaceae - **Rosaceae** – Onagraceae – Lythraceae - Aizoaceae.

UNIT IV

15 Hrs.

Oleaceae – Gentianaceae – Apocynaceae - Solanaceae – Boraginaceae – Bignoniaceae – Pedaliaceae - Nyctaginaceae – **Aristolochiaceae** - Loranthaceae - *Scitamineae* - Commelinaceae - Aroideae – Cyperaceae.

UNIT V

15 Hrs.

Biosystematics- Its aim and scope. Phenotypic plasticity. Turreson's work. Ecological differentiation- *Gene ecology*- Numerical taxonomy.

Note: *Italics* denote Self Study Topics.

Practicals

1. Study of the Taxonomical characters of the above mentioned families with economic importance
2. Preparation of artificial key
3. Submission of herbarium sheets – No. 50.
4. Field trip for 7 Days
5. Visit to BSI / Nilgiri Biosphere National Park

Reference Books

1. **Bennet, S.S.R.**, “*An Introduction to Plant Nomenclature*” International Book Distribution, India, 1989.
2. **Davis & Hey wood**, “*Principles of angiosperm taxonomy*” Today and Tomorrow’s Printers And Publishers, New Delhi, Revised Edition, 1965.
3. **Heslop J. Herrison**, “*New concepts in flowering plants taxonomy*”, Heinemann Educational Books, India, Revised Edition, 1970
4. **Lawrence H.M.**, “*Taxonomy of Vascular plants*”, Mac Millan & Co, New Delhi, 1979.
5. **Rendle A.R.**, “*A Classification of flowering plants*”, Vol. I and II., Cambridge University Press, 1979.
6. **Sokal S.R. and Sneath P.H.**, “*Principles of Numerical Taxonomy*”, N.H. Freeman & Co. 1977.
7. **Solbig**, “*Principles and methods of plant Biosystematics*”, The Mac Millan Company, New Delhi, 1985.
8. **Stace Clive A.**, “*Plant Taxonomy and Biosystematics*”, Edward Arnold, London, Second Edition, 1989.
9. **Attwood, T.K. and Parry Smith, D.J.**, “*Introduction to Bioinformatics*”, Pearson Education Ltd., Fifth edition, New Delhi, 2003.

SEMESTER – III

Core Paper - IX

PLANT PHYSIOLOGY AND PHYTOCHEMISTRY

Instructional Hrs.:90

Sub. Code: 15BOPC309

Max.Marks: CIA 25; ESE -75

Credits:4

Objectives: To learn the metabolic and biochemical reactions in plants.

To understand the movement of water and solute.

To enhance the technical skill in fruit development and fruit ripening

UNIT I

18Hrs.

Water- Structure- Properties- Biological significance- Diffusion- Osmosis- Water potential and Imbibition. A General account of absorption and translocation of water- solutes and assimilates. *Transpiration* and stomatal mechanis- Enzyme: Classification-Properties and mechanism of enzyme action.

UNIT II

18 Hrs.

Photosynthesis- *Photosynthetic pigments*- Mechanism of Photosynthesis : Light reaction – two pigment systems. Electron carriers- photophosphorylation- Carbon fixation in C₃ and C₄ plants- CAM pathway. Photorespiration and glycolate- metabolism.

UNIT III

18 Hrs.

Respiration- Glycolysis- - Pyruvate metabolism. TCA cycle- Electron transport system coupled with Oxidative phosphorylation- Metabolism of Storage protein and fat to carbohydrates-HMP pathway

UNIT IV

18 Hrs.

Growth hormones-General account of Auxin- Gibberellins- Cytokinins- Ethylene - Abscissic acid. Senescence- Phytochrome- Photoperiodism- Vernalisation-*Biological clock*.

UNIT V

18 Hrs.

Biomolecules - Classification- structure and properties of carbohydrates- amino acids- proteins and lipids - secondary metabolites and antioxidant activity (outline only).

Note: *Italics* denote Self Study Topics.

Practicals

a. Plant Physiology

1. Preparation of Molar, Normal, ppm and Percent solutions
2. Determination of Osmotic Pressure (OP) of cell sap of given specimen (Rhoeo leaf)
3. Determination of Diffusion Pressure Deficit (DPD) with potato tuber.
4. Comparison of the rate of respiration in germinating seeds and flower buds using simple Respirometer.
5. Rate of photosynthesis under varying CO₂ concentrations in a water plant.
6. Effect of intensity of light on O₂ evolution during photosynthesis using Wilmott's bubble counter.
7. Determination of water absorption/transpiration ratio.
8. Calculation of stomatal index in upper and lower epidermal peelings and Calculate the percentage of leaf area of Mesophytic leaf
9. Measurement of Respiratory Quotient in germinating seeds.
10. Peroxidase Activity (pH and Temperature)

Demonstration Experiments

1. Nitrification by soil microorganisms.
2. Effect of GA₃ on amylase activity in cereals.
3. Effect of IAA on excised shoot/hypocotyl cuttings of legumes.
4. Hydrolysis of starch by amylase activity.
5. Demonstration of transpiration rate using simple Potometer

b) Bio-Chemistry

1. **pH** : Measure the pH of cell sap and soil solution.
2. **Buffer**: Preparation of phosphate and NaOH buffer.

3) Chromatography

I. Paper Chromatographic technique

Separation of leaf pigments

Separation of amino acids.

II. Thin layer chromatographic technique

Separation of leaf pigments

Separation of sugars

III. Column chromatographic technique to separate chloroplast / Flower pigments.

4) Qualitative and quantitative methods

- i) Extraction of plant material-cold percolation
- ii) Qualitative analysis of phytochemicals
- iii) Total free amino acids (Ninhydrin reagent method)
- iv) Proteins (Lowry *et al.* 1951 method.)
- v) Total soluble carbohydrates (Anthrone method)
- vi) Starch (Clegg's 1956)

Demonstration Experiments

- 1) Agarose gel Electrophoresis
- 2) Determination of absorption spectra of chlorophyll a and b with spectrophotometer
- 3) Extraction of plant materials using Soxhlet Apparatus

Separation of sugars

Reference Books

- 1. **Albert L. Lehninger**, "*Principles of Biochemistry*", CBS Publishers & Distributors, PVT Ltd., New Delhi, 1987.
- 2. **Frank B. Salisbury** and **Cleon W. Ross**, "*Plant Physiology*", CBS Publishers, New Delhi, 1974.
- 3. **Geoffrey Zubay**, "*Biochemistry*", Addison Wesley Publishing Company, Sydney, 1984.
- 4. **Jain, J.L.**, "*Fundamentals of Biochemistry*", S. Chand and Company PVT., LTD., New Delhi, 2002.
- 5. **Malcom S. Wilkins**, "*Advance Plant Physiology*", Longman Group UK LTD., England, 1987.
- 6. **Meirion Thomas, S., Ranson** and **Richardson J.A.**, "*Plant Physiology*", Longman group limited, London, 1973,
- 7. **Robert M. Devlin** and **Francis H. William**, "*Plant Physiology*", CBS Publishers & Distributors, New Delhi, 1972.

SEMESTER – III

Core Paper - X

BIOINFORMATICS

Instructional Hrs.:75

Sub. Code: **ISBOPC310**

Max.Marks:CIA 25; ESE -75

Credits:4

Objectives: To acquire the skill on computer architecture.
To analyse the structure and sequence of biomolecules using New technology.

UNIT I **15 Hrs.**

Introduction to internet-Usage of World Wide Web through Internet Explorer - e- mail server - internet server-URL -HTML - HTTP- FTP - Scope - Fields related to Bioinformatics- Application of Bioinformatics - Human genome.

UNIT II **15 Hrs.**

Molecular biology- General account of Nucleic acid – structure and chemistry of DNA- RNA- Genes - gene Expression-Genetic code- Protein synthesis.

UNIT III **15 Hrs.**

Introduction to Data base - Biological data bases- Objectives of Biological Databases- Types – Sequence data bases- **NCBI** – EMBL - DDBJ - Swiss Prot. PIR-PRF - Structural data bases – PDB - *Carbohydrate database* - Literature databases - Pub Med - Agricola.

UNIT IV **15 Hrs.**

Sequence Analysis- Sequence alignment - Global and local alignment - Multiple sequence alignment. Multiple sequence alignment tools. Phylogenetic analysis - *Construction of phylogenetic tree* and its uses.

UNIT V **15 Hrs.**

Gene finding- Proteomics (general account) - Protein secondary structure prediction - *Data mining* - Drug designing –Pharmacogenomic - *Biomolecular Visualization tools*.

Note: *Italics* denote Self Study Topics

Practicals

Spotters

1. Gene prediction using genemark-Algorithm
2. DNA Data Bank
3. Proteins- Secondary structure prediction- Algorithm
4. Literature Database – Pub Med
5. Sequence Alignment

Reference Books

1. **Andreas, D., Baxevanis, and B.F., Francis,** “*Ouellette Bioinformatics*”, John Wiley Sons Inc., PVT., LTD., Singapore, 2002.
2. **Arthur M. Lesk.,** “*Introduction to Bioinformatics*”, Oxford University Press, New York, 2003.
3. **Baxevanis and Quellette,** “*A Practical guide to analysis of genes and proteins*”, 1998.
4. **Mani, L. and Vijayaraj,** “*Bioinformatics for beginners*”, Kalai Kathir Achagam, Coimbatore, 2002.
5. **Smart M. Brown,** “*A biologist’s guide to bio computing and the internet*” 2000..
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9. **Shanmugavel, P. & Wadhwa G..** “*Practicals in Bioinformatics*”, Pointer Publishers, Jaipur, India, 2009.

SEMESTER – IV

Core Paper - XI

GENETIC ENGINEERING AND BIOTECHNOLOGY

Instructional Hrs.:90

Sub.

Code:15BOPC411

Max.Marks:100

CIA25;ESE-75

Credits:4

Objectives: To understand the transgenic technology in plants.

To study the microbial production of organic acids and organic manure.

UNIT I

18 Hrs.

Genetic Engineering- Concepts of genetic engineering – Scope, Molecular Tools for genetic engineering- Cloning vectors (Out line)-Methods of Gene cloning –Polymerase Chain Reaction - Gene Libraries - Application of Genetic engineering.

UNIT II

18 Hrs.

Gene transfer methods- Nif- Hup- Nod genes- Transgenic plants—Transgenic plants as Bioreactor- DNA sequencing methods

UNIT III

18 Hrs.

Molecular markers and its application- DNA finger printing- Genetic counselling-. Gene therapy, Bone marrow transplantation, methods of gene drug delivery, Recombinant DNA Vaccine, Biochips

UNIT IV

18 Hrs.

Biotechnology and Environmental Protection: Biomining – Bioleaching- removal of metals from water- microbial enhancement of oil recovery. Biomass & Bioenergy-source, Bio Gas, BioHydrogen , Petrochemical Plants

UNIT V

18 Hrs.

Bioremediation & Bio degradation –Types of Bioremediation- Bio degradation of Xenobiotics – Genetically engineered organisms in biodegradation- Bioremediation in soil- Phytoremediation- Global environmental problems and sustainability through Biotechnology- Benefits and ethics of Biotechnology- Patenting Biotechnology inventions.

Note: *Italics* denote Self Study Topics.

Practicals

1. PCR techniques
2. DNA Isolation
3. Biological waste treatment

Spotters

1. Nitrogen fixing genes
- 2 Plasmid
3. Transgenic plants
- 4 Bioleaching

Reference Books

1. **Callow, A.J., Ford Lloyd, B.V. and New bury, H.J.**, *“Biotechnology and Plant Genetic Resources Conversation and Use”*, CAB international, Oxon, UK.,1997.
2. **Dubey, R.C.**, *“A Text book of Biotechnology”*, S. Chand & Company, 1999.
3. **Glazer, A.N. and Nikaid, H.**, *“Microbial Biotechnology”*, W.H. Freeman & Company, New York, USA, 1995.
4. **Gupta, P.K.**, *“Elements of Biotechnology”*, Rastogi Publication, 1998.
5. **Ignacimuthu, S.**, *“Basic Biotechnology”*, Tata Mc Graw Hill Publishing Company Ltd. , Madras, 1985.
6. **Kartha, K.K.**, *“Cryopreservation of plant cells and organs”*, CRC Press, Boca Raton, Florida, USA., 1985.
7. **Santharam, S.**, and **Montgomery, J.F.**, *“Biotechnology- Biosafety and Biodiversity”*, Oxford and IBH Publishing Co., New Delhi,1999.
8. **Kumar, H.D.**, *“Modern Concepts of Biotechnology”*, Vikas publishing house Pvt. Ltd., 2001.

SEMESTER - IV

Core Paper - XII

ECOLOGY AND CONSERVATION BIOLOGY

Instructional Hrs.:75

Sub. Code:15BOPC412

Max.Marks: CIA 25; ESE -75

Credits:4

Objectives: To create Awareness on environmental protection. To study the concept of biotic communities. To conserve biodiversity for future generation.

UNIT I

15 Hrs.

Ecosystem- Structure and function - Types - Autecology - Population ecology- Synecology- Communities - classification - **structure.**

UNIT II

15 Hrs.

Plant Succession- Causes of succession - Climax concept - Types of succession – Hydrosere – Xerosere - Biogeochemical cycles - Hydrological cycle - **Nitrogen** - **oxygen** – Sulphur – Carbon - Phosphorus - **chromium cycle.**

UNIT III

15 Hrs.

Environmental pollution- Types – Soil – Water – Air - Radiation and Noise Pollution- *Green house effect* - Global warming - **Impact of Pollution on vegetation – Ecological indicators.**

UNIT IV

15 Hrs.

Natural Resources- Types – Depletion – Conservation – Sustainable use. Role of Government in Environmental Protection – Awareness Programmes – Ecolabelling- Disaster management and Rehabilitation. *Theme Days for Environmental Awareness: World Environmental day, World Wetlands day, World Forestry day, World Water day, International day for Biological Diversity*

UNIT V

15 Hrs.

Biodiversity- **Importance – Degeneration** – Conservation - *In situ* (Biosphere reserves - National park - Sanctuaries) - *Ex situ* (Zoological and Botanical gardens) - Deforestation and *Social Forestry-* **Man – Wild life conflicts – Causes – Remedial measures.**

Note: *Italics* denote self study topics.

Practicals

1. Determination of Linear changes in vegetation by using line and belt transect methods.
2. Determination of frequency- density- abundance- dominance index. Similarity Index & Diversity Index by using quadrat frame.
3. Estimation of total biomass and herbage yield by harvest method.
4. Description of Zonation in pond and stratification in forest
5. Soil and water
 - i) Garden soil experiment to know texture.
 - ii) pH of the soil
 - iii) Water analysis for dissolved oxygen and CO₂

Reference Books

1. **Ambast, R.S.**, "*A text book of plant ecology.*" Students, Friends & Co., Varanasi, 1988.
2. **Asthana, D.K. and Meera Asthana**, "*A Text book of Environmental studies.*" S. Chand & Co. New Delhi, 2006.
3. **Bhatia, A.L. and Kohli, K.S.**, "*Environmental Biology.*" Ramesh book depot, Jaipur, New Delhi, 2005.
4. **Prabhu,P.C., Udayasoorian, C. and Balasubramanian, G.** "*An Introduction to Ecology and Environmental Science*" Avinash Paperbacks, Delhi, 2009.
5. **Mohan.P.Arora**, Ecology, Himalaya Publishing House, 2006.
6. **Babar,Md.** "*Environmental changes- Natural Disasters*".New India Publishing Agencies, New Delhi, 2007.
7. **Pandey, S.N. and Misra, S.P.** "*Environment and Ecology*, Ane Book Pvt. Ltd., New Delhi, 2011.

SEMESTER – IV
Core Paper - XIII
RESEARCH METHODOLOGY

Instructional Hrs.:75

Sub. Code: 15BOPC413

Max.Marks: CIA 25; ESE -75

Credits:4

Objectives: To know the methods and usage of instruments. To study the methods of writing research articles.

UNIT I

15 Hrs.

Lab techniques- Principles, methodology and uses of Spectroscopy - Infrared, Visible and NMR. Electrophoresis - Agarose gel - *Blotting techniques*-Microscopy -SEM-TEM and Fluorescent - Chromatography - GLC and HPTLC.

UNIT II

15 Hrs.

Lab techniques- Extraction – isolation – characterization, identification and quantification of secondary metabolites- Alkaloid- Flavonoids- Terpenoids and *Glycosides*.

UNIT III

15 Hrs.

Biostatistics- Collection of data – Primary data – Secondary data. Presentation of data - Tabulation graph. *Measures of central tendency - Mean (only arithmetic)- median and mode.* Measures of dispersion – Range - Standard deviation- Standard error. Probability – Theorems of probability. Student's 't' Test. chi-square test - Analysis of variance (ANOVA) - (Theory only)

UNIT IV

15 Hrs.

Research Methodology - Characteristics of research - Objectives of research - Classification of research - Research Process - Research Problems –and -Criteria for selecting research problem - Steps in selecting research problem – Review of literature – Components and purpose , Journal article – web Browsing.

UNIT V

15 Hrs.

Interpretation and Report writing – Steps in writing report- layout of the report - Types of report - *Mechanics of writing.* Manuscript for publication and proof correction. Citation index, impact factor, h – index and plagiarism.

Note: *Italics* denote Self Study Topics.

Practicals

Spotters

1. Principles and working mechanism of Spectrophotometer, Blotting Techniques, SEM, TEM, GLC, HPTLC
2. Problems in Mean, Median, Mode, Standard Deviation, Standard Error, Student 't' test, Chi-square test.

Reference Books

1. **Kothari, C.R.**, *“Research Methodology – Methods and Techniques”*, New Age International Publishers, 2011.
2. **Zar, J.K.**, *“Biostatistical analysis”*, Prentice-Hall International, INC, Englewood cliffs, New Jersey, 1984.
3. **Vijay upagade and Arvind Shende.**, *Research Methodology*, S. Chand & Co., New Delhi, 2010.
4. **Veerakumari, L**, *Bio instrumentation*, MJP Publishers, Chennai, 2009.
5. **Kaur, H.**, *Instrumental methods of chemical analysis*, Pragati Prakashan, Meerut, 2001.
6. **Saravanel, P.**, *Research Methodology*, Kitav mahal, New Delhi, 2010.
7. **Misra, R.P.**, *Research Methodology- A Hand Book*, Concept Publ Company, New Delhi, 2000.
- 8.. **Rama Krishnan, P**, *“Biostatistics”* Saras Publications, Nagercoil, First Edition, 2001.