

SEMESTER – III
Core Paper - VIII
TAXONOMY AND BIOSYSTEMATICS

Instructional Hrs.:75

Max.Marks: CIA 25;ESE -75

Sub. Code:16BOPC308

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 - **Revision** - Keys - Modern trends in Taxonomy- **External morphology** - Anatomy- Embryology-Palynology- Cytology- Chemotaxonomy - *Botanic gardens*

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: Bold and 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. 40.
4. Field trip for 5 Days
5. Visit to BSI / Nilgiri Biosphere National Park

REFERENCES:

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: 16BOPC309

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- Water potential. A General account of absorption and translocation of water- solutes and assimilates. *Transpiration* and stomatal mechanism- Enzyme: Classification-Properties and mechanism of enzyme action.

UNIT- II

Hrs.

18

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

UNIT- III

Hrs.

18

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

Hrs.

18

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

UNIT- V

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

18 Hrs.

Note: Bold and 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 the percentage of leaf area
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. 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 sodium citrate buffer.

3) Chromatography

I. Paper Chromatographic technique

Separation of leaf pigments

Separation of amino acids.

II. Thin layer chromatographic technique

Separation of leaf pigments

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

REFERENCES:

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: **I6BOPC310**

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- 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 and 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 – *Biomolecular Visualization tools*.

Note: Bold and *Italics* denote Self Study Topics.

Practicals:

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

REFERENCES:

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

Max.Marks:100

Credits:4

Sub. Code:16BOPC411

CIA25;ESE-75

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- *Direct* and *vector mediated* - Nif- Hup- Nod genes- Transgenic plants— Transgenic plants as Bioreactor- *Human genome project*.

UNIT- III

18 Hrs.

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

UNIT- IV

18 Hrs.

Biotechnology and Environmental Protection: Biomining – Bioleaching- removal of metals from water- microbial enhancement of oil recovery. Biomass-*Types - composition – conversion* - *Bio Gas* – BioHydrogen - Petrochemical Plants.

UNIT -V

18 Hrs.

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

Note: Bold and Italics denote Self Study Topics.

Practicals

1. PCR techniques
2. DNA Isolation
3. Biological waste treatment
4. Nitrogen fixing genes
5. Plasmid
6. Transgenic plants
7. Bioleaching

REFERENCES:

1. **Callow, A.J., Ford Lloyd, B.V. and New bury, H.J.**, "*Biotechnology and Plant Genetic Resources Conservation 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, Flora, 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: 16BOPC412

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* .

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 **conservation** - *Social Forestry*- Man – Wild life conflicts – Causes – Remedial measures.

Note: Bold and 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. Soil and water
 - i) Garden soil experiment to know texture.
 - ii) Capillary water
 - iii) Chemistry of soil (NO₃, PO₄, SO₄)
 - iv) pH of the soil
 - v) Water analysis for dissolved oxygen and CO₂

REFERENCES:

1. **Ambhast, 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
Max.Marks: CIA 25; ESE -75
Credits:4

Sub. Code: 16BOPC413

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 - **HPLC**.

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: Bold and *Italics* denote Self Study Topics.

Practicals

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

REFERENCES:

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 Publg Company , New Delhi, 2000.
8. **Rama Krishnan, P**, *“Biostatistics”* Saras Publications, Nagercoil, First Edition, 2001.