# BHARATHIDASAN UNIVERSITY

**TIRUCHIRAPPALLI – 620 024**

**M. Phil Classical and Molecular Taxonomy and Systematics (FT / PT) Programme**

(For the candidates to be admitted from the academic year 2007-2008 onwards)

**Semester I**

| | Title of the Course | Marks | | | Credits |
|---|---|---|---|---|---|
| | | IA | UE | Total | |
| Course –I | Research Methodology | 25 | 75 | 100 | 4 |
| Course – II | Classical Taxonomy and Systematics | 25 | 75 | 100 | 4 |
| Course- III | Molecular Taxonomy and Systematics | 25 | 75 | 100 | 4 |

**Semester II**

| | | | | | |
|---|---|---|---|---|---|
| Course – IV | Elective - Biotechnology | 25 | 75 | 100 | 4 |
| | Dissertation and Viva-Voce<br>Viva Voce 50 marks<br>Dissertation 150 marks | | 200 (50+150) | | 8 |

**QUESTION PAPER PATTERN ( Paper I – IV )**

Part - A: Two questions from each unit ( without choice). Each question carries 2 marks. (10 x 2 = 20)

Part – B: One "EITHER OR" questions from each unit Each question carries 5 marks ( 5 x5 = 25 ).

Part – C: One question from each unit. Each question carries 10 marks. The candidate has to answer three questions out of the five questions (3 x 10 = 30 )

# M. Phil Classical and Molecular Taxonomy and Systematics

## SEMESTER I

## COURSE I - RESEARCH METHODOLOGY

**Objectives**

To initiate the students into research activities and to learn to handle various instruments, their principles and applications.

**Unit – I**

Buffers: Characteristics and preparation.
pH meter – principles, measurement of pH, pKa.
Electrometric determination, glass and reference electrodes.
Gas-measuring electrodes – basic principles, applications of Clark electrode.
Centrifuges – principles, types and operation.
Microscopy – Electron Microscopy (tem, sem) Fluorescence Microscopy

**Unit – II**

Chromatography- basic principles – Detailed study of HPLC, principles of Ion exchange; molecular sieve, and affinity chromatography and TLC.
Electrophoresis – basic principles – its types, electrophoretic mobility and factors influencing electrophoretic mobility; Isoelectric focusing, applications, PAGE

**Unit – III**

Tracer techniques – nature of radioactivity, patterns of decay, half life – detection of radiation and measurements by GM Counter, Scintillation counter, autoradiography and applications of Isotopes. Application in Biology – principles, instrumentation – calorimetry, Spectrophotometer, UV/Vis, Flame photometer, Atomic absorption spectrophotometer, NMR and ESR

**Unit - IV**

Measures of Central Values and Dispersion – Probability; Binomial, Poisson and Normal – Correlation and Regression for simple and linear data – Testing of significance – large sample test, t test and chi-square test. Analysis of variance; One and Two way ANOVA.

**Unit – V**

Research – types, objective an approaches. Sample –types: Sampling Techniques.
Hypothesis; Definition, characteristics, types, significance. Literature collection web browsing. Writing review of Literature and Journal articles, impact factor and citation index, Structure of thesis Manuscript for publication and proof correction.

**References**


1. Kothari,C.R. : Research Methodology – Methods & Techniques, Wishwa Prakashan
2. Gupta, S.P : Statistical Methods, Sultan Chand & Sons.
3. Hillis DM *et al*. : Molecular Systematics of Plants
4. Anon : CBE Style Manual (A guide for authors; editors and publishers in biological Science)
5. Freifelder Molecular Biology
6. Reddi, O.S : Recombinant DNA Technology, A Laboratory Manual

## COURSE – II : CLASSICAL TAXONOMY AND SYSTEMATICS

**Unit-I**

The scope of Taxonomy – concept of predicitivity; general and special purpose classifications, alpha and major systems of classification; The development of plant taxonomy – ancient classifications, post-Linnaean, phylogenetic and modern phenetic systems.

**Unit-II**

History of Indian taxonomic botany, taxonomic hierarchy, plant nomenclature – basis, rules and typification. taxonomic keys; Comprehensive view of various approaches to plant classification- natural, artificial, phylogenetic, general and special purpose. ICBN and Basic rules: specimen preparation and herbarium management.

**Unit-III**

Concept of characters. Role of morphology, comparative plant anatomy, embryology, karyology, palynology and paleobotany, ecology and physiology and biochemistry in taxonomy.

**Unit-IV**

Concept of species, ecological plant taxonomy, chemosystematics, serotaxonomy, phytogeography, speciation.

**Unit-V**

Floras and Monographs- their need and methodology, Floristics of Tamil Nadu and Tiruchirappalli district. Ethnobotany in India, folk culture, religion, mythology, medicinal plants.

**References**

Harborne, J.B. & Turner, B.L. 1984, Plant Chemosystematics, Academic Press, London.

Heywood, V.K. & Moore, D.M., 1984, Current Concepts in Plant Taxonomy, Academic Press, London.

Davis, P.H. & Heywood,V.M. 1963, Principles of Angiosperm Taxonomy, Oliver& Boyd, Edinburgh and London.

Lawrence, G.H.M., 1955, The taxonomy of Vascular Plants, Central Book Dept., MacMillan, New York.

## COURSE –III : MOLECULAR TAXONOMY AND SYSTEMATICS

**Unit –I**

*Molecular Systematics:* Context and controversies; collection and storage of cells and tissues. Methods of estimating genetic diversity – isozymes, RFLP, RAPD and its modifications. Applications of molecular systematics.

**Unit – II**

*Plant Genomes*: Generating molecular data- gene mapping and gene sequnencing; Types of molecular data, analysis of molecular data – alignment of sequences, homoplasy, phylogeny reconstruction, gene trees and species trees; molecular characters- chloroplast and mitochondria DNA structure and their role in systematics, Role of RNA in Systematics.

**Unit- III**

Digital Taxonomy – Principles of computer-aided taxonomy – data retrieval systems – Phenetic taxonomy: objectives and hypothesis – selection of operational taxonomic units, character clans and character stage, degree of overall similarity and distimularity, cluster analysis.

**Unit-IV**

*Cladistic taxonomy***:** Use of morphological, phytochemical and molecular data in cladistics. molecular systematics and phylogeny. Softwares and their use in construction of dendrograms and cladistic analysis.

**Unit – V**

Taxonomic data bases – Need for such databases – Taxonomic Databases working Group- The Tree of life – Tree base – Database on Phylogenetic knowledge – Taxonomic information systems- Database at the Royal Botanical Garden – on line herbaria – ETI database – Taxonomic softwares: Linnaeus, Darwin , Species 2000, ILDIS (Legumeline), SA 2000 – other databases on Biodiversity.

**References**


Michael,G. Simpson. Plant Systematics. 2006. Elsevier Academic Press, Burlington, MA.

Gurcharan Singh, Plant Systematics, (2 ed.), 2004. Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi.

Hillis, D.M., Mortiz,C. & Mable, B.K. (eds.) 1996, Molecular Systematics, Sinaver Associates, Sunderland, USA.

Harborne, J.B. & Turner, B.L. 1984, Plant Chemosystematics, Academic Press, London.

Krishnamurthy, K.V. 2003. An Advanced Text Book on Biodiversity. Oxford & IBH, New Delhi.

## SEMESTER - II

### COURSE – IV: BIOTECHNOLOGY (Elective)

## Objectives

i) To study the techniques used in genetic engineering
ii) To explore the possible applications and future potentiality of biotechnology

**Unit - I**

Basic principles – mechanism of natural gene transfer by *Agrobacterium*; Ti plasmids Generation of foreign DNA molecules – Enzymes used in Genetic Engineering – restriction enzymes – their types and target sites; cutting and joining of DNA molecules – linkers, adapters, homopolymers; Cloning vehicles and their properties – natural plasmids, *in vitro* vectors. Phages, cosmids and T-DNA based hybrid vectors. Cloning with sstr. DNA vectors.

**Unit – II**

Cloning strategies – cDNA and genomic libraries; Recombinant selection and screening methods. Expression of cloned genes – Problems and solutions, shuttle vectors; DNA sequencing strategies – Sanger's and Maxam – Gilbert's methods. Applications of PCR and DNA hybridization – Southern Northern and Western blotting.

**Unit – III**

Techniques of tissue culture – culturing explants and haploids, protoplasts fusion and embryoids. Methods of gene transfer to plants, animals and bacteria – Ca-transfection, electroporation, shot gun, Micro injection, biolistics and lipofection. Transgenic plants; GM foods and biopesticides. Gene knockouts and transgenic animals – animal pharming and xenografting. Biodegradation stimulation and its applications. Bioleaching.

**Unit – IV**

Biosafety of GMOs and GM foods. Genetic Use Restriction Technology (GURT); Patenting of genes, cell and life forms; TRIP rights; Genomics – Arabidapsis, rice. Gene therapy-types, principles and applications. Gene drain – the tangled genes – Uniformity and genetics loss: directed recombination and Recombinant DNA Technology.

**Unit – V**

Plant metabolites engineering-food vaccines, bioplastics, plantibodies, plantigens, Production of Transgenic plant for herbicide resistance, and drought, salt, disease tolerance, quality improvement, antisesne RNA. Biotechnology and its applications: Ti and Ri plasmids-its role. Golden rice, biotrasfermation of high value metabolites through cell, tissue and organ culture. Somatic embryogenesis and synthetic seeds.

**References**


1. Lewin, B. (2000) : Genes – VII Oxford University Press, New York.
2. Old R.W. and Primrose, S.B. : Principles of Gene Manipulation, Blackwell Scientific (1989) Publication, London.
3. Dubey, R.C. : A Textbook of Biotechnology
4. Narayanaswamy : Plant Cell and Tissue Culture
5. Primrose S B & R M Twyman : Genomics, applications in Human Biology
6. Joshi, P : Genetic Engineering and its applications
7. Watson *et al.* : Molecular Biology of the Gene.