

**BHARATHIAR UNIVERSITY :: COIMBATORE – 641 046**  
**M.PHIL. / PH.D. – BOTANY**  
**PART I : SYLLABUS (Effective from the academic year 2006-2007 onwards)**

**PAPER I – RESEARCH METHODOLOGY**

**UNIT 1:**

Principals and methodology of colorimetry, spectrophotometry, pH meter, dialysis and lyophilisation, centrifugation, basic principles underlying different types of centrifuges.

**UNIT II:**

Chromatography – partition, thin layer adsorbtion, sephadex, ion exchange, gas liquid chromatography, HPLC.

Electrophoresis - Agarose electrophoresis, polyacrylamide disc and slab gel with and without SDS, urea, 2-mercaptoethanol and ampholytes and electrofocusing.

**UNIT III:**

Nucleic acids – isolation and purification. Southern, Western and Northern hybridization techniques, Colony hybridization. Polymerase Chain Reaction, Genome mapping; molecular markers – RFLP, RAPD, AFLP.

**UNIT IV:**

Culture techniques – microbe and plant tissue (cell and organs) – media preparation (PDA, Nutrient Agar, CHU-10), Bolds basal medium, MS medium, Gamborg medium). Sterilization techniques, Cytological techniques – pretreatment, fixatives and stains.

**UNIT V:**

Field and herbarium methods: materials for revision, monographs, flora and vegetation studies. Botanical nomenclature, phytogeography of India.

Phytochemistry – Extraction, isolation, characterization and identification of terpens, alkaloids and flavanoids.

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**PAPER II – TRENDS IN PLANT SCIENCE**

**UNIT 1:**

Fundamentals of microbial degradation – organisms and materials involved. Factors affecting microbial growth. Biochemistry of degradation. Agro-waste utilization with special reference to litter.

**UNIT II:**

The concept of energy richness in plants – lignocellulose, sugars and terpenoids. Basic knowledge of plants yielding fuel, wood, waxes, alcohol and hydrocarbons.

**UNIT III:**

Germplasm resources – definition, scope, conservation, work done in India. Utilization of germplasm of (1) Paddy (2) Chickpea (3) Pigeonpea and (4) Sugarcane.

**UNIT IV:**

Ethnobotany in relation to human welfare : Elementary knowledge of crude drugs – Preparation and preservation; Classification of active principles and their distribution in plant parts.

**UNIT V:**

Greenhouse effect; ozone depletion; plant indicators of pollution, role of vegetation in pollution control.

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**PAPER III: PLANT CYTOGENETICS**

**UNIT I:**

Architecture of the chromosome – prokaryotic and eukaryotic chromosomes – plasmids, episomes, transposomes; Genomes of mitochondria and plastids – Euchromatin and heterochromatin – Chromatin and nucleosome – B-chromosomes and special types of chromosomes

**UNIT II:**

Structural changes in chromosomes – Duplications, Deficiencies, Inversions and Translocations – classification, identification, meiotic pairing, breeding behaviour and role in evolution of structural changes.

**UNIT III:**

Numerical changes in chromosomes : Haploidy – classification, methods of production, identification and utility. Polyploidy – Auto and Allopolyploidy, their classification, meiotic pairing, production, utility and role in evolution; Aneuploidy – trisomy, tetrasomy, monosomy, and nullisomy.

**UNIT IV:**

Chromosome banding techniques – Different types and their application. In-situ hybridization. Induced mutation in plants and their application.

**UNIT V:**

Alien gene transfer through chromosome manipulation – whole genome, individual chromosome, individual gene. Molecular markers and their utility – PCR, RAPD, RFLP, AFLP, VNTR, SSR.

References:

Gupta, P.K. 1995. Cytogenetics. Rastogi and Company. Meerut.

Swanson, C.P. 1972. Cytology and Cytogenetics. Macmillan India Ltd. New Delhi.

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**PART I – Syllabus (Effective from the academic year 2006-2007 onwards)**

**PAPER III. MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY**

**UNIT I: Gene Concept**

DNA as genetic material. DNA structure, organization and replication. Organization of Pro and Eukaryotic genome . Gene expression – Genes in development – gene regulation. Control of gene expression. Terminator gene technology

**UNIT II: Plant Tissue Culture**

Types of cultures – Callus, organ, embryo, cell and protoplast. Micropropagation, Germplasm storage and conservation *in-vitro*, somaclonal variation, haploid production with reference to Rice, wheat, Sugarcane, and Cotton

**UNIT III: Gene Transfer Techniques**

Characterization of specific genes, Gene isolation methods - Direct gene transfer methods – electroporation – microinjection – biolistics – PEG mediated – liposome mediated and plastid transformation. Indirect gene transfer methods – Agrobacterium mediated gene transfer

**UNIT IV: Transgenic in Crop Improvement**

Production of transgenic for resistance to abiotic (low and high temperature, salt, herbicide) and biotic (pests and diseases). Quality improvement – protein enrichment, improvement in shelf life, male sterility, antisense messenger RNA, Bioreactors.

**UNIT V : Markers and IPR**

Marker assisted selection for crop improvement – PCR, RAPD, RFLP, AFLP, SSR, EST Genome mapping. Intellectual property Rights – Forms of protection – copy right, trade mark, patent. Plant Breeders rights

References:

1. Chawla, H.S. 2002. Introduction to Plant Biotechnology. 2<sup>nd</sup> Ed. Oxford University Press and IBH.
2. Gupta, P.K. Elements of Biotechnology, Rastogi, Meerut.
3. Lindsey, K. 1997. Transgenic Plant Research, Harwood Acad. Pub.
4. Primrose, S.B. Molecular Biotechnology, Blackwell Sc. Publications.
5. Chahal, G.s. and Gosal, S.S. 2002. Principles and Procedures of Plant Breeding. Narosa Publ Hos. New Delhi.

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**PART I – Syllabus (Effective from the academic year 2006-2007 onwards)**

**PAPER III. ENVIRONMENT AND CONSERVATION BIOLOGY**

**UNIT I:**

Scope of Environmental Biology, Ecosystem, Energy Flow. Pollution – Air, Water and Soil – Its impact on plant, control measures.

**UNIT II:**

Global warming, Ozone depletion and Green house effect. Energy – sources – Fossil fuels, natural gas, wind energy, Bio energy and energy conservation.

**UNIT III:**

Historical account of conservation of fauna and flora in India: Phytogeographical regions. Biodiversity –Types, values, threats and “Hotspots”.

**UNIT IV:**

Plant genetic resources: Conservation strategies for plant genetic resources (in situ and ex situ). IUCN classification – Red data book. Role of NBPGR, WWF, UNDP, IPGRI, FAO in conservation programmes in India.

**UNIT V:**

Human dimension in ecosystem management – Predominant ethnic communities of India – with special reference to Tamil Nadu and their role in conservation of plants. Tribal development programmes in Indian society and environment. Tribal bill.

**References:**

1. Sharma, P.D. Environmental Biology.
2. Patel, A.H. Industrial Microbiology.
3. Krishnan Kannan. Fundamentals of Environmental pollution.
4. Whittakar, R.H. Ecosystem.
5. R.G.Bondand and C.P Straub. Environmental Control
6. Khan, T.I. and Shishoda, Y.S. (1998). Biodiversity conservation and sustainable development., Pointer Publ., Jaipur
7. Trivedi, P.R. and Gurudeep Raj. 1992. Environmental Wildlife and Plant conservation. Akashdeep Publ. Hojuse, New Delhi.
8. Agarwal, K.C. 1996. Biodiversity. Agrobotanical Publishers, India.
9. Jain, S.K. 1995. A manual of Ethnobotany, 2<sup>nd</sup> Ed..
10. Mukherjee, B. 1997. Environmental Biology, Tata McGrew Hill Publ. Co. Ltd. New Delhi.

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PART I – Syllabus (Effective from the academic year 2008-2009 onwards)

PAPER – III - BIOPROSPECTING OF MEDICINAL AND AROMATIC PLANTS

**UNIT-I**

Plant genetic resources and their conservation: Medicinal and Aromatic Plants – Scope and importance. Approaches and strategies for *ex-situ* conservation: botanical garden, arboreta, herbal garden and field gene bank.

**UNIT-II**

General principles of chromatography. Principle, instrumentation and application of HPLC, GC, GC-MS,. Extraction methods: distillation, steam and solvent.

**UNIT-III**

Classification, chemical nature and tests for carbohydrates, proteins, alkaloids and terpenoids. Antifungal and antiviral drugs. Stress physiology: Drought and freezing resistance, Heat shock and salinity stress.

**UNIT- IV**

Pharmacology: Routes of drug administration, absorption and distribution. Pharmacological activity of morphine, atropine, ephedrine and camphor. Chemotaxonomy of higher and lower plants and distribution of certain chemotaxonomical group of constituents in plant kingdom like alkaloids, glycosides and terpenoids.

**UNIT-V**

Post harvest technology in medicinal crops: scope and importance. Adulteration with reference to plant drugs, type of adulterants and method of adulteration. Importance of herbal marketing. Biodiversity act and Intellectual Property Right in the area of medicinal plants.

## References:

1. Goodman Gillman's The Pharmacological basis of therapeutics. (2001) Ed. Hardman JG, Limbird LE (Tenth Edition) McGraw Hill press New York.
2. Wilson K and John Walker, 1999. Principles and techniques of practical biochemistry, Cambridge University Press.
3. Drug Discovery and Evaluation –Pharmacological assays. (1997) Ed. Vogel HG & Vogel WH. Springer-New York.
4. Aktal C K and B M Kapur, 1982. Cultivation and utilization of medicinal plants. RRL, CSIR, Jammu-Tawi.
5. Mukherjee P. K. (2002). *Quality Control of Herbal Drugs*, Business Horizons Pharmaceutical Publisher, Delhi, 1st edn.
6. Harborne J.B. 1998. *Phytochemical Methods - A guide to modern technique of plant analysis*, 3rd edn, Chapman & Hall, UK.
7. Ali, M. 1997. *Textbook of Pharmacognosy*, CBS Publishers and Distributors, New Delhi.
8. Chaudhary R. D 1996. *Herbal Drug Industry*, 1st edn, Eastern Publication, New Delhi.
9. Trease, G. E. and Evans, W. C. 1985. *Pharmacognosy*, Bailliere Tindall. London. 12th edn.
10. Wijeskera, R. O. B. 1991. *The medicinal Plant Industry*, CRC Press, Boston, London.
11. Finar, I. L. 1975. *Organic Chemistry, Stereochemistry and the Chemistry of Natural Products*, ELBS, Longman Singapore Publication (P) Ltd., Singapore, 5th edn.
12. Swain T. 1963. *Chemical Plant Taxonomy*, Academic Press London.
13. Anonymous. 1993. *Standardization of Single Unani Drugs*, CCRUM, New Delhi.

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**PART I – Syllabus (Effective from the academic year 2006-2007 onwards)**

**PAPER III - MICROBIOLOGY AND PLANT PATHOLOGY**

**Mycology**

**UNIT I**

Fungal cell and its structure; Reproduction, Factors affecting asexual spore formation, maturation, spore dispersal mechanisms, dormancy and germination.

Fungal nutrition, use of fungi in immobilized cell technology (outline only).

**UNIT II**

Ectomycorrhiza – Structure and development, Growth and carbon economy, Nitrogen and phosphorous nutrition, Ectendomycorrhizas.

Endomycorrhiza – Arbuscular mycorrhiza: fungi involved, Root colonization and anatomy, Genetic, Cellular and molecular interactions, Growth and carbon economy of AM plants, Mineral nutrition, heavy metal accumulation and water relations of AM plants.

Role of mycorrhizas in ecosystems - AM in agriculture and horticulture - Mycorrhizas in managed environment: forest production, interactions with other microorganisms and pollutants.

**Plant pathology:**

**UNIT III**

Effects of pathogens on host physiology, Genetic basis of host – Pathogen interaction – pathogenesis – Toxins –Definition, Classification, Chemistry, production and mode of action of bacterial toxins with special reference to wildfire toxin – Chemistry production and synthesis of fungal toxins with reference to Helminthosporium toxin – Host defense mechanisms – Epidemiology, assessment and forecasting of plant diseases.

**Applied microbiology**

**UNIT IV**

Microbes and soil fertility: Nitrogen fixing organisms (Symbiotic, nonsymbiotic and associative)- phosphate solubilizers (bacteria and fungi) – Inoculum production

Microbes in plant protection: Biological control of plant pathogens – Mechanism – bio-insecticides, bio-herbicides, biofungicides.

**UNIT V**

Application of microbes in sewage and wastewater treatment, degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents, composting, Microbial biosensors.

Microorganisms as source of food – single cell protein, Cultivation of mushrooms

**Reference books :**

1. The filamentous fungi – Vol. IV – fungal technology.
2. Physiology of fungi – V.W. Cochrane.
3. Fundamentals of Mycology – Burnett.
4. An Introduction to Mycology – R.S. Mehrotra & K.R. Aneja
5. The fungal spore – formation & function - D.J. Weber & W.H. Hess.
6. Plant Pathology – G.W. Agrios.
7. Plant Pathogenesis – H. Wheeler.
8. Microbiology – Michael J. Pelezar Jr., E.C.S. Chacor. Noel R. Krieg.
9. Microbiology – Fundamentals & applications – S.S. Purohit.
10. General Microbiology – Vol. II – Powar & Daginawala.
11. Mycorrhizal Symbiosis – Smith, S. E. & Read, D.J.
12. Plant Pathology – Sharma, P.D.
13. Applied Microbiology – Ahmed, M. & Basumatary, S. K.

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**PAPER III - ALGOLOGY**

**UNIT I : TAXONOMY**

Modern criteria (biochemical, cytological, physiological, ultra structural) in taxonomy and phylogeny of algae current taxonomic treatment of algal phyla. Fossil algae.

**UNIT II : CULTURE**

Isolation and culture and pure culturing of algae. Synchronous cultures, mass cultures, variations of algae in culture.

**UNIT III : PHYSIOLOGY**

Nutrition, photosynthesis and respiration, N<sub>2</sub>-fixation in blue greens. Cyanoophyages. Morphogenesis in algae.

**UNIT IV : ECOLOGY**

Occurance and seasonal distribution of fresh water and marine algae. Fresh water and marine phytoplankton and phytobenthos. Thermophilic algae; soil algae; algae in relation to pollution.

**UNIT V : GENETICS AND BIOTECHNOLOGY**

Mutation, recombination, molecular biology and biotechnology of cyanobacteria with special reference to *Spirulina*. Agricultural and industrial uses of algae.

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**PAPER III: PHYSIOLOGICAL EMBRYOLOGY AND TISSUE CULTURE**

- UNIT I :** Anther development: Physiological and cytological studies, androgenesis and haploids. Ovary, ovule and nucellus culture.
- UNIT II :** Biochemical embryogenesis. Embryo culture techniques and application. Somatic embryogeny physiology of the development of somatic embryos; strategies for large scale manipulations of somatic embryos. Synthetic seeds – production and application.
- UNIT III :** Endosperm culture and application, somaclonal and gametoclonal variation. Impact on plant biology and breeding strategies. Storage of germplasm and germplasm exchange. Production of secondary metabolites *in vitro*.
- UNIT IV :** Protoplast isolation, culture, fusion and establishment of culture. Uptake of organelles and organisms. Somatic hybridization by protoplast fusion. Implication for agriculture. Genetic engineering through (vector/vectorless) protoplast culture.
- UNIT V :** Trends and prospects of tissue culture technology; Improvement of food and energy crops (a general trends); Application in Forestry; Disease elimination – Meristem culture. Tissue culture in India – Potentials and progress.

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**PAPER III - SEED TECHNOLOGY**

- UNIT I :** Germplasm resources of food grains – pulses, cereals and oil seeds – collection and *ex situ* and *in situ* conservation – Role of IPGRI (International Plant Genetic Research Institute) (Rome), NBPGR (New Delhi) and ICRISAT (Patancheru, Andhra Pradesh) in germplasm collection and conservation of most common cereal and pulse crops.
- UNIT II :** Biochemical composition of legume and cereal seeds/grains. Seed proteins – albumins, globulins, glutelins and prolamines their structure, function and composition. Seed carbohydrates – starches and soluble carbohydrates including flatulence factors, structure and composition. Seed oils and lipids – structure and composition.
- UNIT III :** Physiology of seed/grain development-growth patterns – sigmoid and double sigmoid growth curves – phases of growth – role of pericarp (hull), seed coats and flag leaf in seed/grain development. Biosynthesis of proteins, carbohydrates, lipids during seed grain development.
- UNIT IV :** Physiology of seed germination – primary/early biochemical events of germination. Appearance and role of proteases, amylases and lipases in hydrolyzing stored food materials in storage organs. Mobilization of hydrolysed products to the growing embryonal axis/seeding.
- UNIT V :** Antinutritional factors – Heat labile and heat stable antinutritional factors in food grains – their structure and role in human nutrition – Different processing methods to eliminate (post harvest technology) decrease antinutritional factors.

**References :**

1. (Eds) Bewley, J.D. and M. Black, 1985. Seeds : Physiology of development and germination, Plenum Press : New York.
2. (Ed) Murray, D.R. 1984. Seed Physiology Vol. I & II. Academic Press. Sydney – New York – London.
3. (Eds) Mehta S.L., Lodha, M.L. and Sane, P.V. 1993. Recent Advances in Plant Biochemistry. Publication and Information Division ICAR, New Delhi.
4. (Ed) Weil J.H. 1990, General Biochemistry, Wiley Eastern Limited, New Delhi.
5. (Eds) D.K. Salunkhe, Kadam S.S. and Chavsan J.K. 1985. Post harvest Biotechnology of food legumes. CRC Press, Boca Raton, Florida, USA.
6. (Eds) Salunke D.K., Chavan J.K., and Kadam S.S. (1985) CRC Press, Boca Raton, Florida, Post harvest Biotechnology of Cereals. USA.
7. (Eds) Arora S.K. (1982) Chemistry and Biochemistry of food legumes, Oxford and IBH Publication, New Delhi.
8. (Eds) Daussant, J., Mosse.J and Vaughan, J. (1983). Seed Proteins, Academic Press, New York, USA.

9. (Eds) Summerfield R.J. and Bunting A.H. (1980). *Advances in legume Science*, Kew, Richmond, Surrey, U.K: Royal Botanic Gardens.
10. Murray, D.R. 1987, Nutritive role of seed coats in developing legume seeds. *Amer. J. Bot* 74 : 1122 – 1137.
11. Higgins T.J.V. 1984. Synthesis and regulation of major proteins in seeds. *Ann Rev. Plant Physiol.* 35:191-221

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**PAPER III - MEDICO - BOTANY**

- UNIT I** : Ethnobotany in human welfare – food, health-care conservation, bio-chemistry. Regional studies, recent trends and socio-economic aspects.
- UNIT II** : Pharmacognosy – Introduction, the oldest modern science classification of vegetable drugs, identification of drugs (taxonomical, anatomical, fluorescence, chemicals, organoleptic, microscopic only).
- UNIT III** : Sources of vegetable drugs – Biological, geographical and cultural. Production of vegetable drugs – role of growth regulators. Deterioration of drugs and their control measures.
- UNIT IV** : Chemistry of vegetable drugs – acid, alcohol, ester, carbohydrate, phenolic compounds, volatile oils, resin, saponin and cardioactives.
- UNIT V** : Importance and significance of flavonoids, alkaloids tumor inhibitors, vitamins, hormones, pesticides and antibiotics of plant origin.

**References :**

1. Anna de Pasquale 1984 – Pharmacognosy: The oldest modern Science, *J. Ethnobiology*, 11:1-16.
2. Anonymous 1970 – The Pharmacopoeia of India – Govt. of India, New Delhi.
3. Chase, P.R. and Pratt 1949 – Fluorescence of powdered vegetable drugs with particular reference to development of a system of identification *J.Am. Pharm. Assoc.* 38:324-331.
4. Jain S.K. (Ed.) 1996 – Ethnobiology in human welfare. Deep. Pub. A/3/27A DDA Flats Pashim Vihar, New Delhi.
5. Nadkarni K.M. 1954 – Indian Materia Medica, Karnataka Printing Press, Bombay.
6. Trease G.E. and Evans W.C. 1978 – Pharmacognosy Bailliere Tindal, London.
7. Wallis T.E. 1985 – Text Book of Pharmacognosy (5<sup>th</sup> Ed) CBS Pub. Distributors. Bhole North Nagar, Delhi – 110 032.
8. Harborne J.B. – Phytochemical Methods (2<sup>nd</sup> Ed.) Chapman and Hall. London.

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**PAPER III - FLORISTICS, TAXONOMY & ETHNOBOTANY**

- UNIT I** : History of classification (pre and post – Darwinian). Aims of taxonomy. Units of classification, taxonomic hierarchy, concepts of families, genera, species and infraspecific taxa. Importance of characters, including anatomical, cytological, embryological and palynological, in taxonomy.
- UNIT II** : Herbarium and its functions. Major herbaria in India. Floras, revisions and monographs. Botanical nomenclature. History of floristic studies in peninsular India.
- UNIT III** : Ethnobotany (particularly) of south Indian tribals. Ethnobotanical aspects of conservation and management of plant resources. Importance of wild relatives of cultivated plants.
- UNIT IV** : Floristic regions of India. Flora of peninsular India and their affinities and endemism with particular reference to angiosperms. Vegetation/forest types in peninsular India.
- UNIT V** : Floristic diversity (flowering plants) in peninsular India. Services rendered and goods supplied by tropical forests. Causal factors of degradation and depletion of tropical forests. Rare and endangered species of flowering plants and their *in situ* (including National parks, Wildlife sanctuaries and biosphere reserves in peninsular India) and *ex situ* conservation.