



**DEPARTMENT OF BOTANY**  
**PERIYAR UNIVERSITY**  
(Reaccredited with A Grade by NACC)  
SALEM - 636 011  
TAMIL NADU, INDIA

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**M.Phil., Botany - Revised Syllabus**  
**(2018 - 2019 onwards)**

**PERIYAR UNIVERSITY**  
**PERIYAR PALKALAI NAGAR**  
**SALEM - 11**  
**DEGREE OF MASTER OF PHILOSOPHY (M.PHIL) IN BOTANY**  
**(Choice Based Credit System)**  
**REGULATIONS AND SYLLABUS**  
**FULL - TIME / PART -TIME**

**1. Eligibility for Admission:**

Candidate who has obtained the M.Sc. degree in Botany/ Plant Sciences and life Sciences of the Colleges/University or an Examination of any other University accepted by the Syndicate of Periyar University as equivalent thereto shall be eligible for admission to M. Phil., Degree of this University. The candidate eligible to register for the Degree of Master of Philosophy (M. Phil.) in Botany he/she has to undergo the prescribed course work in an department of this University. Candidates who have passed their postgraduate degree in Botany on or after 1<sup>st</sup> January 1991 shall be required to have obtained a minimum of 55% of marks to become eligible to register for the Degree of Master of Philosophy (M.Phil.) and undergo the prescribed course of study in an approved Institution or department of this University. For the candidates belonging to SC/ST community and those who have qualified for the Master's Degree after 01.01.1991 the minimum eligibility marks shall be 50% in their Master's Degree.

**2. Duration of the course:**

The duration of the M.Phil. Programme shall be one year consist of two semesters under Choice Based Credit System

**3. Distribution of Credit points**

The minimum credit requirement for one year M.Phil, programme shall be 24 Credits.

The break-up of credits for the programme is as follows:

<b>PART I</b>		
<b>1</b>	Research methodology	4 credits
<b>2</b>	Advances in Botany	4 credits
<b>3</b>	Guide Paper	4 credits
<b>PART II</b>		
<b>4</b>	Dissertation	8 credits
<b>5</b>	Viva Voce	4 credits
<b>Total</b>		<b>24 Credits</b>

#### **4. Course of Study:**

The courses of study for the M.Phil. Degree shall be in Botany (Choice Based Credit System) with internal assessment according to syllabi prescribed from time to time. The Internal Assessment mark is distributed to 3 components viz Tests, Seminar and Attendance as 10,10and 05marks, respectively. There are Three Courses under Part-I for Semester I and Dissertation & Viva Voce under Part-II for Semester II. The Third Course in the first semester shall be specialization related to the dissertation. The student in consultation with the research supervisor must select the third course and the research supervisor should frame the syllabus.

#### **The allotment of marks for (i) Theory (ii) Dissertation and Viva Voce are as follows:**

##### **(i)Theory Papers**

Internal: 25 Marks

External: 75 Marks

Total: 100 Marks

##### **(ii) Project Dissertation**

Dissertation: 100 Marks

Internal: 50 Marks

Viva Voce: 50

Marks Total: 200

Marks

**(iii) Internal assessment for course I, II and III**

Test: 10 Marks

Seminar: 10 Marks

Attendance: 05 Marks

Total: 25 Marks

## 5. Course scheme and scheme of Examination

Part	Course	Course Code	Course Title	Credits	Internal Marks	External Marks	Total
I	I	13QBOTC01	Research Methodology	4	25	75	100
	II	13QBOTC02	Advances in Botany	4	25	75	100
	II	13QBOTE01	Guide Paper	4	25	75	100
II	IV	13QBOTD01	Dissertation	8	50	100	200
			Viva Voce	4		50	
<b>Total</b>				<b>24</b>	<b>125</b>	<b>375</b>	<b>500</b>

### 5. Scheme of Examinations (Two

#### Semesters):

#### Part-I Written Examination:

The examination for the courses I, II and III under Part-I shall be held at the end of the **FIRST SEMESTER**. Each course carries a maximum of 100 marks of which 75 allotted for external and 25 for internal. The internal assessment mark is distributed to 3 components *viz* tests, seminar and attendance as 10, 10 and 05 marks, respectively. The syllabus for paper III shall be framed by the Guide and the same should be submitted to the University for Approval. The examination of paper III will be conducted by the Guide in the College/Departments and the marks obtained by the candidate along with the question paper and valued answer scripts shall be sent to the university at least 15 days before the commencement of the examinations of Papers I and II. The examiners will be appointed from the panel of four names of each paper (I and II) submitted by the College/Departments concerned. If one examiner awards a pass mark and the other fail mark, the paper will be valued by a third examiner whose award of marks will be final.



## **Part -II - Dissertation:**

The exact title of the dissertation shall be intimated within one month after the registration of the course. Candidates shall submit the dissertation to the university through the supervisor and Head of the Department at the end of the **SECOND SEMESTER** from the commencement of the course which shall be valued by internal examiner (supervisor) and one external examiner appointed by the university from a panel of four names sent by the supervisor through the Head of the Department / Principal at the time of submitting the dissertation.

The examiners who value the dissertation shall report the merit of candidates as “Highly Commended” (75% and above) or “Commended” (50% and above and below 75%) or “Not Commended”(below 50%). If one examiner commends the dissertation and the other examiner, does not commend, the dissertation will be referred to the third examiner and the third valuation shall be final. Submission or resubmission of the dissertation will be allowed twice a year subject to the University rules.

### **6. Question paper pattern:**

Time: Three Hours  
Maximum Marks : 75

#### **Part - A ( 5 X 5 = 25 Marks)**

**Answer ALL questions** (Two questions from each unit with internal choice)

#### **Part - B (5 X 10 = 50 Marks)**

**Answer ALL questions.** (Two Questions from each unit with internal choice)

### **7. Dissertation:**

#### **a) Topic:**

The topic of the dissertation shall be assigned to the candidate within one month (based on paper III) after registration and a copy of the same should be submitted to the University for approval. The maximum marks for submitting the dissertation is 150 marks.

**b) Number of copies of Dissertation:**

The students should prepare four copies of dissertation and submit the same to the University for the Evaluation.

**c) External viva-voce compulsory:**

There is a compulsory viva-voce by an external examiner and the maximum marks for the viva-voce is 50 marks.

**Format to be followed:**

The format of the dissertation to be submitted by the students is given below.

**Format for the preparation of project work:**

- (a) Title Page
- (b) Bonafide Certificate
- (c) Acknowledgement
- (d) Table of contents

<b>Content</b>	
<b>1</b>	Introduction
<b>2</b>	Review of Literature
<b>3</b>	Materials and Methods
<b>4</b>	Results
<b>5</b>	Discussion
<b>6</b>	References

**Format of the Title page:****TITLE OF THE DISSERTATION**

Dissertation Submitted in partial fulfilment of the requirement for the award of Degree of Master of Philosophy in BOTANY to the Periyar University, Periyar Palkalai Nagar, Salem - 636 011.

By

Student's Name:

Register Number:

Department/College:

Month and Year:



**Format of the Certificate:**

**CERTIFICATE**

This is to certify that the dissertation entitled ...(Title)....submitted by ..... (Candidate Name)..... to the Periyar University, Salem in partial fulfilment of the requirement for the award of degree of Master of Philosophy in **BOTANY** is a bonafide record of work carried out by the candidate during ..... in the Department and that no part of the dissertation has been submitted for the award of any Degree / Diploma / Associateship / Fellowship or other similar titles that the Dissertation represents independent work on part of the candidate under my guidance.

Date:

Place:

Signature of the  
Guide

Signature of the Head of the Department

**8. Passing Minimum:**

The candidate shall be declared to have passed Part-I of the examination if he/she secures not less than 50% marks (i.e. 50 marks) in the University examination in each paper. A candidate shall be declared to have passed Part - II of the examination if his/her dissertation is at least commended. All other candidates shall be declared to have failed in the examination.

**9. Restriction in number of chances:**

No candidate shall be permitted to reappear for the written examination in any paper for more than two occasions or to resubmit a Dissertation more than once. Candidates" shall have to qualify for the degree passing all the written papers and dissertation within a period of three years from the date of joining the course.

## **10. Conferment of Degree:**

No candidate shall be eligible for conferment of the M.Phil. Degree unless he/she is declared to have passed both the parts of the examination as per the Regulations.

## **11. Qualifications for persons conducting the M.Phil. Course:**

No teacher shall be recognized as a supervisor unless he/she possesses a Ph.D. degree or two years of PG teaching experience after qualifying for M.Phil. or M.Litt. Degree. Only the postgraduate departments of affiliated colleges and departments of the university will be recognized for conducting the M.Phil. Course; provided however, the syndicate shall have the power to decide any other institutions of higher learning/research within the university area for conducting the M.Phil. Course on merits as per the regulations of Periyar University.

### **PART - TIME**

### **M.Phil, BOTANY**

## **12. Eligibility for Admission:**

- i) Teacher candidates working in the Botany Department of the University.
- ii) Teacher candidates working in the Department of Botany of affiliated colleges and whose qualifications are approved by the university.
- iii) Teacher candidates working in polytechnics approved by the Director of Technical Education or in Higher Secondary Schools and High Schools approved by State Board or Central Board of Secondary Education or Educational Institutions of IAF (within Periyar University area) who possess a Master's Degree. For the Master's Degree qualified prior to 01.01.1991, no minimum marks is prescribed; but on or after 01.01.1991, a minimum of 55% of the marks is prescribed, provided that for the candidates belonging to SC/ST community a concession of 5% marks will be given in the minimum eligibility marks prescribed.

## **13. Duration of the course:**

The course of study extends over period of two years from the date of admission to the course. The examinations for part - I shall be taken at the end of the first year and part - II Dissertation at the end of the second year.



#### **14. Regulations for the part - time M. Phil.,**

The regulations governing the full time M.Phil., course with regard to course of study, scheme of examinations passing minimum, etc and qualifications of guide conducting the M.Phil., course shall apply to part - time candidates also.

#### **15. Restriction in number of chances:**

No candidate shall be permitted to reappear for the written examination in any paper on more than two occasions or to resubmit a Dissertation more than once. Candidates shall have to qualify for the degree passing all the written papers and dissertation within a period of four years from the date of commencement of the course.

#### **16. Commencement of this regulation:**

These regulations shall take effect from the academic year 2013 - 2014, that is, for students who are admitted to the first year of the course during the academic year 2013 - 2014 and thereafter.

## **I SEMESTER (Part I)**

### **PAPER I Paper Code: 13QBOTC01 RESEARCH METHODOLOGY**

#### **Unit I**

Selection of research topics and data retrieval: Using library, internet, compiling of working bibliography. Principles of experimental designs. Principles of thesis writing - Research Report: Types of reports - contents - styles of reporting - Steps in drafting reports - Editing the final draft - Evaluating the final draft.

#### **Unit II**

Basics of common phytochemical techniques including their modern trends for qualitative and quantitative analysis of listed compounds: chromatography, spectrophotometry, electrophoresis, centrifugation and tracer techniques.

#### **Unit III**

Sample collection for microbial analysis: surface and subsurface soils, rhizospheric soils, water, air. Handling of samples, preparation for microscopy (liquid cultures, soil samples); confocal laser scanning microscopy, SEM, TEM, STEM, AFM, Flow cytometry, imaging. Estimation of microbial biomass (methods based on C content, DNA content, fumigation). Cultural methods, MPN method.

#### **Unit IV**

Plant Tissue Culture and Plant Micro techniques: Principles and applications of plant tissue culture, fixatives, methods of fixation, methods of dehydration, embedding, sectioning and staining. Herbarium Methodology: Collection, poisoning, drying and preservation of herbarium specimens, Important National and International herbaria.

#### **UNIT - V**

Collection of data: Steps, modes and precautions in the collection of data, primary Vs secondary data, editing of secondary data; sampling theories. Condensation of data: Measures of central tendency (Mean, Median and Mode) and measure of dispersion (range, mean deviation, standard deviation). Representation of data: graph and diagrams. Analysis of data: Correlation, regression, test of significance (F- test, T- test, Z- test and  $\div 2$  test).



## Reference

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- Plummer, D.T. An Introduction to practical biochemistry. Tata MC Graw Hill Co. New York.
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- Chawla, H.S. 2000. Introduction to biotechnology. Oxford and IBH publishing Co., New Delhi.
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- Sabari Ghosal and Srivastava A. K. 2009. Fundamentals of Biological Techniques and Instrumentation. PHI Learning Private Ltd. New Delhi.

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- Mahajan. B.K. 1997. Methods in Biostatistics. Jay Pee Brothers Medical Publishers (P) Ltd. New Delhi.
- Bernard Rosner. 2010. Fundamentals of Biostatistics. Brooks/cole, Boston, USA.
- Agarwal, B.L. 1988. Basic Statistics. New Age International Publishers. New Delhi.
- Sahu, P.K. 2013. Research Methodology: A Guide for Researchers in Agricultural Science, Social Science and other related fields. Springer, New Delhi.



**PAPER II**  
**Paper Code: 13QBOTC02**  
**ADVANCES IN BOTANY**

**Unit- I**

Evolutionary trends amongst Algae, Fungi and Bryophytes. Evolutionary trends amongst Pteridophytes, Gymnosperms and Angiosperms.

**Unit - II**

Genomics: Whole genome sequencing and functional genomics. Proteomics: Protein Engineering – Achievements and prospects. *Arabidopsis thaliana* and rice genome projects and their importance.

**Unit- III**

Anthropogenic impact on Ecosystems and Climate Change; Ozone depletion, Global warming, Carbon budgeting. Biodiversity: Endemism, Variation, Biodiversity Hotspots, Biodiversity Indicators, Biodiversity Conservation, Invasive Alien Species.

**Unit - IV**

Plant transgenic biology and Genetic Engineering: Applications in Agriculture, Health and Industry. Secondary Metabolites: Types and their production through tissue culture. DNA sequencing methods, micro-array based techniques; isolation, separation and analysis of carbohydrates and lipid molecules; RFLP, RAPD and AFLP techniques

**Unit V**

Molecular biology and recombinant DNA methods: Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods; analysis of RNA, DNA using AGE. Proteins by SDS - PAGE one and two dimensional gel electrophoresis, protein sequencing methods.

**Reference**

- Alexopolous, C.J., Mims, C. W. and Blackwel, M. 2002. Introductory Mycology (4th Ed.), John Wiley & Sons, Inc., New York, USA.
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Biotechnology and Genetic Engineering, PHI Learning Pvt. Ltd.

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- Richard M. Twyman, 2013. Principles of Proteomics, Garland Science.
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## **GUIDE PAPER - SPECIALIZATION**

1. PLANT TISSUE CULTURE: APPLICATIONS AND PROSPECTS
2. MICROBIOLOGY AND PLANT PATHOLOGY
3. PLANT BREEDING WITH MOLECULAR TOOLS
4. PLANT PHYSIOLOGY
5. PLANT NUTRIENT TECHNOLOGY
6. MEDICINAL BOTANY
7. ALGAL BIOLOGY AND BIOTECHNOLOGY
8. PLANT BIODIVERSITY - CONSERVATION AND MANAGEMENT

# **PLANT TISSUE CULTURE: APPLICATIONS AND PROSPECTS**

## **13QBOTE01**

### **Unit I**

Application of Biotechnology in conservation of plant generic resources, Gene banks. Application of tissue culture in Agriculture: Plant improvement through tissue culture technology; production of resistant lines to biotic and abiotic stresses.

### **Unit II**

Applications of tissue culture in horticulture: micropropagation of some tree species like Morus, Ficus etc. Application of tissue culture in forestry: In vitro establishment of Mycorrhiza forest species, orchids, and other related improvements in forest species Eg. Tectona, Pinus etc. Prospects in plant tissue culture industry in India; Applications in public sector.

### **Unit III**

Secondary metabolite production - Secondary metabolites from callus, cell cultures, cell suspension, biotransformation. Procedure for process design and product recovery from cultures plant cells. Factors affecting product yield. Secondary metabolites form immobilized plant cell.

### **Unit IV**

Transgenic plants for crop improvement. Marker genes and their use in transformed plants, selectable markers, reporter genes. Molecular farming, bioreactor, edible vaccines, edible antibodies.

### **Unit V**

Intellectual property; IPR: Intellectual property Rights, Intellectual property protection, IPR and Plant Genetic Resources GATT and TRIPS. Patent systems in India, Sources of patent information; a case study, patenting biotechnological inventions: Patent of higher plants, Patent of genes and DNA Sequences, Plant breeders rights and farmer's right.

### **References**

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# **MICROBIOLOGY AND PLANT PATHOLOGY**

## **13QBOTE01**

### **UNIT I: Mycology**

Classification of Fungi, General character of fungi, fungal cell and its structure; fungal nutrition, Reproduction, Factors affecting asexual spore formation, maturation, spore dispersal mechanisms, dormancy and germination. Use of fungi in immobilized cell technology.

### **UNIT II: Host and Microbes Interaction**

Fungi as symbionts - 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.

### **UNIT III: Plant pathology**

Effects of pathogens on host physiology, Genetic basis of host - Pathogen interaction - Mechanism of infection. Role of enzymes and toxins in 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.

### **UNIT IV: Applied microbiology**

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 - bioinsecticides, bio-herbicides, biofungicides.

### **UNIT V: Industrial Applications**

Biofertilizers-Types: Nitrogenous (Symbiotic, Non-symbiotic), Phosphate solubilizers -Biopesticides: Bacillus thuringiensis, Pseudomonas, Viruses. Xenobiotics- microbial mechanism, microbial mining, ore leaching - Solid waste management (composting)-vermicomposting- biofuel (Algae)- oil spill remediation- Wastewater treatment: primary, secondary and tertiary (Biological), heavy metal removal- Steroid biotransformation. Microorganisms as source of food - single cell protein, Cultivation of mushrooms

## References:

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- Alexopoulous, C.J. and Mims, C.W. 1979. *Introductory Mycology*. Wiley Eastern Ltd., New Delhi, 632

## **PLANT BREEDING WITH MOLECULAR TOOL**

### **13QBOTE01**

**Objectives:** This course is designed to provide basic and practical knowledge of plant breeding, cytogenetics, mutation and molecular breeding.

**Outcome:** The course is to give the students increased practical knowledge of plant breeding theories, crop improvement and its techniques, advanced molecular breeding technologies.

#### **Unit - I Principles of Cytogenetics**

Historical perspective on Genetics; Mendelian principles; Mobile genetic elements and dynamic nature of genome; Cell division; behaviour of chromosomes during meiosis and its significance. Chromosome structure: Karyotype analysis. Numerical variation in chromosome and their utility.

#### **Unit - II Principles of Plant Breeding**

Introduction, domestication and acclimatization. Patterns of evolution in crop plants, centres of origin, gene pool concept. Plant genetic resources and diversity in plant breeding, collection, evaluation and conservation of germplasm. Heritability and genetic advance. Selection, Heterosis - concept and theories. Methods of breeding self-pollinated, cross-pollinated and asexually propagated crops. Completely randomized design.

#### **Unit III Improvement of Field Crops**

Eminent Plant Breeders and their achievements; Breeding methods of specific crops like cereals (wheat, rice, barley, maize, sorghum and millets); pulses (Black gram, pea, lentil, pigeonpea, mungbean, cowpea and lathyrus); oilseeds (Brassica, soybean, groundnut), fibre crops (cotton, jute); forage crops (oat) and asexually propagated crops; National and international institutes for crop improvement.

#### **Unit IV - Mutagenesis**

History of experimental mutagenesis. Nature of mutations, spontaneous mutations, Physical and Chemical mutagens. Transposons as mutagens, Somaclonal variation. Screening techniques and selection procedures of induced mutations and its application. Specificity of mutation induction and directed mutagenesis; targeted gene replacement; gene silencing.

## **Unit - V Molecular Breeding for Stress Resistance**

Introduction to plant genetic engineering and biotechnology, gene identification, gene isolation, synthesis of genes and gene cloning. Biotic and abiotic stress. Breeding for tolerance to abiotic stresses: moisture, salinity, alkalinity, water logging, temperature. Molecular markers assisted selection Molecular Breeding - morphological, biochemical and DNA based markers. Molecular mapping and tagging of agronomically important traits. QTLs analysis in crop plants.

### **References**

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4. Fehr, W.R. 1987, Principles of Cultivars Development (Vol. I). Mac Millan Publishing Company Inc., New York.
5. Griffiths, A.J.F.; Miller, J.H; Suzuki, D.T.; Lewontin, R.C. and W.M. Gelbart(1996). An Introduction to Genetic Analysis. (6th Edition). W.H. Freeman, New York.
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12. Poehlman, J.M. 1986, Breeding Field Crops. AVI Publishing Company, Connecticut.
13. Prasad, G. 1998. Introduction to Cytogenetics. Kalyani Publishers, New Delhi.
14. Sharma, J.R. 1998. Statistical and Biometrical Techniques in Plant Breeding. New Age International Publishers, New Delhi
15. Singh, B.D. 2000. Plant Breeding-Principles and Methods. Kalyani Publishers, New Delhi.
16. Singh, R.K. and Chaudhary, B.D. 1997. Biometrical Methods in Quantitative Genetic Analysis. Kalyani Publishers, New Delhi.

17. Sinha, U. and Sinha S. 1998. Cytogenetics, Plant Breeding and Evolution. Vikas Publishing House Pvt. Ltd., New Delhi.
18. Strickberger, M.W. 1996. Genetics (3rd edn.). Mac Millan Publishing Co., New Delhi.
19. Swaminathan, M.S., Gupta, P.K. and Sinha, U.1974. Cytogenetics of Crop Plants. Mac Millan India Ltd., New Delhi.

### **Reference Books**

- Mahabal Ram, 2014. Plant breeding methods. Published by PHI learning private limited. New Delhi.
- Jack Brown, Peter D.S. Caligari, Hugo A. Campos. 2014. Plant breeding-2<sup>nd</sup> edition of introduction of plant breeding-revised and update. Published by Wiley Blackwell Ltd.
- Singh, B.D. and A.K. Singh. 2015. Marker- Assisted plant breeding: principles and practices. Springer.
- George Acquaaah 2012. Principles of plant genetics and breeding second edition published by Wiley Blackwell.
- Roberto Frischa-Neto and Aluizio Boron. 2012. Plant breeding for abiotic stress tolerance published by Springer.

## **Plant Physiology**

### **13QBOTE01**

**Objectives:** The aim of this course is to provide current knowledge to students about the basic theories and principles of plant physiology, plant regulation mechanisms, stress physiology.

**Outcome:** The course will help to understand the plant physiology and metabolism, plant growth and development mechanism with various environmental factors.

#### **Unit - I Bioenergetics and Photosynthesis**

Structure of atoms, molecules and chemical bonds, principles of physiological chemistry, Principles of thermodynamics, free energy, Redox potentials Dissociations and association's constants, Activation energy, binding energy. Photosynthesis: Light harvesting complexes; mechanisms of electron transport; photo protective mechanisms; CO<sub>2</sub> fixation-C3, C4 and CAM pathways. Photorespiration and its regulation. Respiration- RQ, Factor affecting respiration.

#### **Unit- II Water relation and Respiration**

Regulation of water supply, Aquaporins and facilitated water Transport, soil plant atmosphere continuum (SPAC), recent concept in stomatal physiology, signal transduction in guard cell. Respiration and photorespiration: citric acid cycle and plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photo respiratory pathway. Glycolysis in plant and its regulation, regulation of pentose phosphate pathway and TCA cycle. Regulation of electron transport chain and role of alternate oxidase.

#### **Unit- III Carbohydrate and Secondary Metabolism**

Regulation of starch and sucrose biosynthesis, synthesis and degradation of cellulose. A brief idea of pectin biosynthesis and enzymes involved in pectin degradation. Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles

#### **Unit- IV Nitrogen Metabolism**

Assimilation of nitrate and ammonium ion, amino acid biosynthesis. -NR, NIR, GDH and GS/GOGAT pathways, Transamination and other method. Integration of nitrogen and carbohydrate Metabolisms.

## **Unit - V Plant hormones and Stress Physiology**

Sensory photobiology: structure, function and mechanism of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks. phytochromes mediated processes. Physiology of flowering and fruit ripening, physiology of seed germination, dormancy of seed, causes and methods of breaking dormancy. Ageing and senescence types, physiological and biochemical changes.

Types of plant hormones and applications; auxins, gibberellins, cytokinins, ethylene and abscisic acid, Biosynthesis physiological effects and mechanisms action. in agricultural and horticultural, physiology of growth retardants. Response of plant to biotic (pathogenic and insects) and abiotic (water, temperature, salt and metal) stresses; mechanism of resistant to biotic stress and tolerance to abiotic stress. Free Radicals and Antioxidants.

### **Suggested Reading**

1. Buchanan B. B, Gruissem W. and Jones R. L 2000. Biochemistry and molecular
2. Biology of plants. American society of plant physiologists Maryland, USA
3. Dennis D.T., Turpin, D.H. Lefebvre D.D. and Layzell D.B. (eds) 1997. Plant
4. Metabolism (Second Edition) Longman, Essex, England.
5. Galstone A.W. 1989. Life processes in plant. Scientific American Library, Springer Verlag, New York, USA.
6. Moore T. C. 1989. Biochemistry and Physiology of plant Hormones Springer- Verlag, New York, USA.
7. Verma S. K and Verma Mohit 2007. A. T. B of plant physiology, Biochemistry and Biotechnology, S. Chand Publication.
8. Bidwell, R.C.S. (1979); Plant Physiology.
9. Sadashivam and Manikam (1996): Plant Biochemical Methods
10. Jain, V.K. 2000. Fundamentals of Plant Physiology (5th ed.), S. Chand & Co Ltd; New Delhi
11. Machlis, L. and Torrey, J.G. 1956. Plant in action: Laboratory manual of plant physiology. W.H. Freeman publisher, San Francisco
12. S N Pandey & B K Sinha PLANT PHYSIOLOGY fourth edition.
13. C.P. Malik & A.K. Srivastava Text Book of Plant Physiology



## **Reference Books**

1. Park S. Nobel. (2009), Physicochemical and Environmental Plant Physiology
2. William G. Hopkins, Norman P. A. Hüner Introduction to Plant Physiology, 4th Edition ISBN: 978-0-470-24766-2 Dec 2008

# **PLANT NUTRIENT TECHNOLOGY**

## **13QBOTE01**

### **Unit I: Plant Nutrition**

Nutrition and water uptake (transpiration, respiration, absorption, adhesion-cohesion theory) Essential Macro elements: functions and deficiency symptom of element, Nitrate and Ammonium, Phosphate, Potassium, Magnesium, Calcium, Sulphur microelements: Zinc, Molybdenum, Manganese, Cobalt, Copper, Iron, Chlorine, Boron, Integrated nutrient management.

### **Unit II: Nitrogenous Biofertilizer**

Definition, Plant Growth Promoting Rhizobium with practical as application as biofertilizer, Rhizobium spp., Advantages and Constrains of Biofertilizers. Classification of fertilizers (synthetic fertilizers and natural fertilizers), Organic Fertilizers, Biofertilizers, compatibility of Fertilizer Materials, Fertilizer Application Method, Compositing.

### **Unit III: Phosphate biofertilizers**

Mycorrhizae - Ecto and endomycorrhizae and their importance in agriculture. Isolation of AM fungi - Wet sieving method and sucrose gradient method. Mass production of AM inoculants and field applications. Isolation and Purification of phosphate solubilizers. Mass multiplication and field applications of phosphate solubilizer (*Pseudomonas striata*).

### **Unit IV: Soil Microbiology**

The Nematodes, The Microfauna, Protozoa and Archezoa, Algae; Green Algae, diatoms, Environmental effects, Fungi: types of fungi, functional roles, symbiotic nitrogen fixation. Soil Organic Matter and Humus. Soil borne pathogens.

### **Unit V: Production technology**

Production technology: Strain selection, sterilization, growth and fermentation, mass production of various biofertilizer. Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings. Extension, promotion and marketing. Biofertilizers - Storage, shelf life, quality control.

### **References**

- Bagyaraj, D.J. and A. Manjunath. 1990. Mycorrhizal symbiosis and plant growth, Univ. of Agricultural Sciences, Bangalore, India.
- Purohit, S.S., P.R. Kothari and S.K. Mathur, 1993. Basic and Agricultural Biotechnology, Agro Botanical Pub. India.

- Subba Rao, N.S., G.S. Venkataraman and S. Kannaiyan 1993. Biological nitrogen fixation, ICAR Pub., New Delhi.
- Somani, L.L., S.C. Bhandari, K.K. Vyas and S.N. Saxena. 1990. Biofertilizers, Scientific Publishers - Jodhpur.
- Tilak, K.V.B. 1991. Bacterial Biofertilizers, ICAR Pub., New Delhi.
- Alexander M. (1977) Introduction to soil microbiology. John Wiley & Sons, Inc., New York.
- Rogers JE and Writman WB (1991) Microbial production and consumption and green house gases: Methane: Nitrogen oxides and Halomethanes. American Society for Microbiology, Washington DC.
- Dirk J, Elas V, Trevors JT, Wellington, EMH (1997) Modern Soil Microbiology, Marcel Dekker INC, New York.

## **MEDICINAL BOTANY**

### **13QBOTE01**

#### **Unit I: Medicinal plants and their Importance**

Medical Botany; introduction, History, Definition-Classification-Common medicinal plants cultivation, storage, collection and habitats of medicinal plants- importance of medicinal plants.

#### **UNIT II: Indian System of Medicine**

Indian systems of medicine of medicine-Siddha, Ayurveda, Homeopathy & Unani- Local medicine plants- Useful parts-chemical constituents- medicinal uses-medicinal plants drugs.

#### **UNIT III: Herbal medicine**

Herbal medicines for human ailment-heart, kidney, liver, eye, skin, hair, stomach problems, diabetics, blood pressure, headache, cough, cold, fever, digestive problems, joint pains.

#### **UNIT IV: Pharmacognosy**

Pharmacognosy - Introduction commercial drugs, crude drugs-classifications of drugs history - pharmaceuticals aids- chemistry of drug and drug evaluation of natural products.

#### **UNIT V: Herbal products**

Drug adulteration and detection - substitution - detection of adulterations Elementary knowledge on Alkaloids, Volatile oils, Resins, Triterpenoid drugs.

#### **References**

- Kumar, N.C., An Introduction to Medical Botany & pharmacognosy.
- Shaha, S.C. and Qudary (1993). A text book of pharmacognosy.
- Nadkarni, 1981. Indian Material Medica.

- Jain, S.J., Rao, C. 1976. A hand book of field and Herbarium techniques.
- Gamble, J.S., 1973, Flora of the Presidency of Madras.

## **ALGAL BIOLOGY AND BIOTECHNOLOGY**

### **13QBOTE01**

#### **Unit - I: Fundamentals of Phycology**

Introduction - Review of algological studies - algal taxonomy - thallus organization and ultra structure of algae - biochemical, Physiological, Ecological and cytological importance of algae.

#### **Unit - II: Cultivation methods of Algae**

Introduction - methods and techniques of collection, preservation and their importance - Culturing techniques - Fresh and marine water - cultivation, culture media and staining of algae.

#### **Unit - III: Utilization of Algae**

Research and development in algae - Economic importance of algae - Biofertilizer - Pharmaceuticals - biofuel - Industrial uses - harmful aspects - algal indicators - algal blooms - Fossil algae.

#### **Unit - IV: Applications of Algae**

Algal biodiesel; method of preparation - applications and their advantages - Blue Green Algae(BGA), Seaweed Liquid Fertilizer (SLF) method of preparation, applications and their importance in organic manures

#### **Unit - V: Biotechnological approaches**

Biotechnological potential of algae - Algal immobilization and its applications - Algal causing biological disturbances; control methods of algae; Phycoremediation - role of algae in nanobiotechnology.

#### **References**

- Trivedi, P.C. 2001. Algal Biotechnology. Printer publishers, Jaipur, India.
- Barsanti, L. and Gualtieri. P. 2006. Algae: Anatomy, Biochemistry and Biotechnology, CRC press, USA.
- Khattar, J.I.S., Singh, D.P., and Gurpreet Kaur. 2009. Algal Biology and Biotechnology. I. K. International (Pvt) Ltd. New Delhi.
- Vanden Hoek, C., Mann, D.G., and Jahns, H.M. 1995. Algae: an Introduction to phycology, University of Cambridge, New York.
- Linda. E. Graham, James M. Graham and Lee Warren Wilcox. 2009. Algae. Benjamin- Cummings Company.
- Sambamurthy, A.V.S.S. 2005. A text book of Algae. I.K. International Pvt. Ltd. New Delhi.
- Sharma, O.P. 2011. Algae. Tata MC Graw Hill, New Delhi.
- Robert Arthur Anderson. 2005. Algal Culturing techniques. Elsevier. USA.
- Chen, F and Jiang, Y. 2001. Algae and their biotechnological potential. Kluwer Academic Publishers. Netherland.

## **PLANT BIODIVERSITY - CONSERVATION AND MANAGEMENT 13QBOTE01**

### **Unit - I: Plants as Natural Resources**

Biodiversity - Definition - Plant Biodiversity - plants as natural resources - Utilization of plant resources - Industrial value - and other useful aspects.

### **Unit - II: Significance of Plant biodiversity**

Plant biodiversity - Forest biodiversity - Agricultural biodiversity - Loss - Endemism - rare, endangered and threatened species - challenge of plant biodiversity - red data book - Hot spots - vegetation types and Bio-geographical regions of India.

### **Unit - III: Conservation of Plant Biodiversity**

Plant biodiversity conservation - aims and objectives -genetic diversity, species diversity, ecosystem diversity, plant community diversity - role of biotechnology in conservation of plant resources - Ex-situ - in-situ conservation techniques (National parks, Biosphere Reserves Programme, Tissue culture, Botanical gardens, gene and seed banks.

### **Unit - IV: Medicinal Plant biodiversity**

Medicinal plant biodiversity - Introduction - History - Classification - Cultivation of medicinal plants - Industrial utilization of medicinal plants - Indigenous medicinal plants and their utilization - phytochemicals and

pharmaceuticals from medicinal plants - conservation and sustainable uses of medicinal plants – Sacred plants and their importance.

### **Unit - V: Management of Plant biodiversity**

Emerging trends in plant biodiversity conservation – plant resources management – Nursery and horticultural practices – Applications in organic manure - Bio-control agents – Phytoremediation – Bioprospecting and Pharmaceuticals.

### **References**

- Frankel, O.H., Anthony Brown, H.D. and Jermy, Burdon, J. 1995. The conservation of Plant Biodiversity. University of Cambridge. USA.
- Muthuchelian, K. 2013. Perspectives in Plant Biodiversity. Astral International Pvt. Ltd. New Delhi.
- Muthuchelian, K. 2012. Biodiversity Conservation and Management. Astral International Pvt. Ltd. New Delhi.
- Hawksworth. ,D.L and Bull, A.T. 2007. Plant Conservation and Biodiversity. Springer.
- Singh, M.P., Singh, B.S., and Soma Dey. 2002. Plant Biodiversity and taxonomy. Daya Publishing house, New Delhi.
- Arvind Kumar. 2005. Biodiversity and Conservation. APH Publishers, New Delhi.
- Krishnamurthy, K.V.K. 2003. A text book of Biodiversity. Science Publishers, USA.
- Tandon, P., Abrol, Y.P. and Kumaria, S. 2007. Biodiversity and its Significance. I.K. International Publications. New Delhi.
- Chaudhuri, G.A. 2007. Endangered Medicinal Plants. Daya Publishing house. New Delhi.