



# **Mangalore University**

**M.Sc., APPLIED BOTANY**



**CHOICE BASED CREDIT SYSTEM**

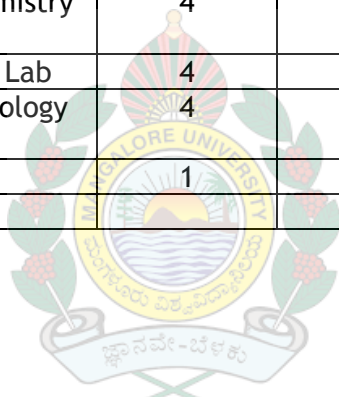
**SYLLABUS**

**2010-2011**

# COURSE PATTERN AND SCHEME OF EXAMINATION

**MANGALORE UNIVERSITY**  
**M.Sc., APPLIED BOTANY (CBCS)**  
**Course pattern and scheme of Examination**

semester	Course Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
					IA	Exam	Total	
I semester	AB 401	Plant Morphology and Taxonomy- I	4	3	30	70	100	4
	AB 402	Plant Biochemistry	4	3	30	70	100	4
	AB 403	Cytogenetics and Molecular Biology	4	3	30	70	100	4
	AB 404	Basic Microbiology	4	3	30	70	100	4
	AB 405	Plant Morphology and Taxonomy Lab- I	4	3	15	35	50	2
	AB 406	Plant Biochemistry Lab	4	3	15	35	50	2
	AB 407	Cytogenetics Lab	4	3	15	35	50	2
	AB 408	Basic Microbiology Lab	4	3	15	35	50	2
	AB 409	Seminar	1	-	25	--	25	1
		<b>Total</b>					<b>625</b>	<b>25</b>

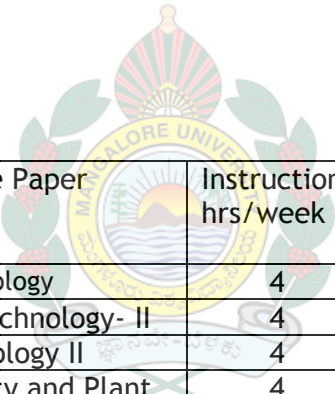


semester	Course Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
					IA	Exam	Total	
II semester	AB 451	Plant Morphology and Taxonomy- II	4	3	30	70	100	4
	AB 452	Plant Physiology	4	3	30	70	100	4
	AB 453	Plant Breeding	4	3	30	70	100	4
	AB 454	Applied Microbiology	4	3	30	70	100	4
	AB 455	Plant Morphology and Taxonomy Lab- II	4	3	15	35	50	2
	AB 456	Plant Physiology Lab	4	3	15	35	50	2
	AB 457	Plant Breeding and Biometrics Lab	4	3	15	35	50	2
	AB 458	Applied Microbiology Lab	4	3	15	35	50	2
	AB 459	Seminar	1	--	25	--	25	1
<b>Total</b>							<b>625</b>	<b>25</b>

semester	Course Code	Title of the Paper	Instruction hrs/week	Duration of Exam (hrs)	Marks			Credits
					IA	Exam	Total	
III semester	AB 501	Choice based course # Medicinal Plants	4	3	30	70	100	4
	AB 502	Plant Biotechnology-I	4	3	30	70	100	4
	AB 503	Plant Pathology I	4	3	30	70	100	4
	AB 504	Ecology and Environment	4	3	30	70	100	4
	AB 505	Medicinal plants - Lab/ Project work *	4	3	15	35	50	2
	AB 506	Plant Biotechnology Lab- I	4	3	15	35	50	2
	AB 507	Plant Pathology Lab- I	4	3	15	35	50	2
	AB 508	Ecology and Environment Lab	4	3	15	35	50	2
	AB 509	Seminar	1	--	25	--	25	1
Total							625	25

# Students can opt this course from any Department of his/her choice.

\* Project work will be offered on the basis of availability of sufficient staff.



semester	Course Code	Title of the Paper	Instruction hrs/week	Duration of Exam (hrs)	Marks			Credits
					IA	Exam	Total	
IV semester	AB 551	Seed Technology	4	3	30	70	100	4
	AB 552	Plant Biotechnology- II	4	3	30	70	100	4
	AB 553	Plant Pathology II	4	3	30	70	100	4
	AB 554	Bio-diversity and Plant Conservation	4	3	30	70	100	4
	AB 555	Seed Technology Lab	4	3	15	35	50	2
	AB 556	Plant Biotechnology Lab- II	4	3	15	35	50	2
	AB 557	Plant Pathology Lab-II	4	3	15	35	50	2
	AB 558	Bio-diversity and Plant Conservation- Lab	4	3	15	35	50	2
	AB 559	Seminar	1	--	25	--	25	1
Total							625	25

## SEMESTER I

### AB 401 - PLANT MORPHOLOGY AND TAXONOMY - I

#### Unit I: (12 Hours)

Algae: Study of different kinds of classifications - thallus organisation, Life cycle pattern and general reproductive biology of Cyanophyceae, Chlorophyceae, Phaeophyceae, Xanthophyceae, and Rhodophyceae; Fossil algal records; economic importance.

#### Unit II: (12 Hours)

Bryophyta: Study of different kinds of classifications, Life cycle patterns and reproductive biology of Hepaticae, Anthocerotae and Musci. Ecological and economic use of Bryophytes. Evolution of land plants and significance of bryophytes.

#### Unit III: (14 Hours)

Brief history of taxonomic studies in India. Contributions of Van Rheedee, William Roxburgh, Natithaniel Wallich, Robert Wight, J.D. Hooker, R.H. Beddome and George Watt. Organisation and functioning of the Botanical Survey of India of pre and post independent India. Taxonomic tools - Herbarium: methodology and its significance; Floras.

#### Unit IV: (10 Hours)

Botanical nomenclature: Principles; typification (type method); priority; ranks of taxa and nomenclature of taxa; effective and valid publication; citation; retention, choice and rejection of names and epithets; conservation of names (nomina conservanda).

Systems of classification : Concept of Artificial, Natural and phylogenetic systems of classification - study of Bentham & Hooker's system and Hutchinson's system of classification. (Reference to other systems of classification may be made whenever relevant while treating the families.)

#### Unit V: (12 Hours)

The study of the following families with their phylogeny as per Bentham & Hooker's system:

Magnoliaceae, Annonaceae, Menispermaceae, Nymphaeaceae,  
Brassicaceae, Capparidaceae, Caryophyllaceae, Clusiaceae,  
Dipterocarpaceae, Malvaceae, Sterculiaceae, Teliaceae,  
Oxalidaceae, Balsaminaceae, Rutaceae, Meliaceae, Celastraceae,  
Rhamnaceae, Vitaceae, Leeaceae, Sapindaceae, Anacardiaceae,  
Leguminosae, Rosaceae, Droseraceae, Rhizophoraceae,  
Combretaceae, Myrtaceae, Melastomataceae, Lythraceae,  
Passifloraceae, Cucurbitaceae, Cactaceae, Apiaceae.

## **Suggested Reading**

Armen Takhtajan. 1969. Flowering plants - Origin and Dispersal. Oliver and Boyd Ltd. Tweeddale Court, Edinburgh, pp. 310.

Bennet, S.S.R. 1979. An Introduction to Plant nomenclature. International Book Distributors. 9/3. Rajpur Road, Dehra Dun 248001. India.

Bhargava M., 2003. Algae 1st Ed, Dominant Publisher, New Delhi.

Davis, P.H., V.H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd Ltd., Tweeddale Court, Edinburgh.

Heywood V.H., 1976. Botanical Systematics, Academic Press London.

Hock. C.V.D., D.G. Mann & H.M. Jalms. 1993. Algae - an introduction to phycology, Cambridge University Press.

Hutchinson. J. 1973. The Families of Flowering Plants. Oxford University Press, Elky House, London. W.I., pp. 968.

Lawrence, H.M. 1966. Taxonomy of Vascular Plants. The MacMillon Company. New York, pp. 823.

Robert Edward Lee 1989. Phycology II End. Cambridge University Press.

Singh S.K., 2006. Text Book of Bryophyta 1<sup>st</sup> Ed, Campus Book International Publisher New Delhi.

Sivarajan V.V., 1985. Introduction to Principle of Plant Taxonomy, Oxford and IBH Publication, New Delhi.

## **AB 402 - PLANT BIOCHEMISTRY**

### **Unit I (12 Hours)**

Membranes : structure, chemical composition, models, transport processes - passive, active, bulk transport.  
Plant enzymes - classification, kinetics and mechanism of action.

### **Unit II (12 Hours)**

Respiration: mitochondrial structures, Carbohydrate bio synthesis, classification, structure and metabolism, glycolysis, HMP pathway, uronic acid pathway, T.C.A. Cycle, E.T.S. & oxidative phosphorylation; factors affecting respiration.

### **Unit III (12 Hours)**

Proteins and aminoacids: classification, structure - primary, secondary, tertiary and quaternary; biosynthesis and separation (aminoacid sequence, C-terminal, N-terminal, disulfide bonds).

Lipids: classification, structure, function and biosynthesis of fatty acids; Beta oxidation.

Nucleic acids: classification, structure, biosynthesis, functions and metabolism.

### **Unit IV (12 Hours)**

Vitamins - classification, distribution, structure, production, function.  
Secondary plant products: structure, biosynthesis and distribution of terpenes, phenolics and nitrogen containing compounds.

### **Unit V (12 Hours)**

Nitrogen fixation and metabolism: Nitrogenase, nitrogen fixation, storage and transport.

Signal transduction: Receptors, proteins, phospholipid signalling, role of cyclic nucleotides, calcium - calmodulin cascade, protein kinases and phosphatases. Specific signalling mechanisms in Bacteria and Plants.

### **Suggested Reading:**

Buchanan, B.B., Gruissem, W. and Jones, R.L. 2007. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.

Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (eds) 1997. Plant Metabolism. Longman, Essex, England.

Dey P.M. and Harborne J. B., 2000. Plant Biochemistry. Academic press, USA.

Dryer, R.L. and Lata, G.F. 1989. Experimental Biochemistry. Oxford University Press, New York.

Godwin, T.W. and E.I. Mercer 1983. Introduction to Plant chemistry. Pergamon press. USA.

Heldt H.W. and Heldt. F., 2005. Plant Biochemistry, Academic press, California.

Lea, P.J. and R.C. Leegood, 1993. Plant Biochemistry and Molecular Biology, John Wiley and Sons. USA

Madigan M.T., Martinko T. M and Parker J., 2000. Brock Biology of Microorganisms 9<sup>th</sup> Ed, Prentice Hall international, Inc USA.

Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones. Springer-Verlag, New York, USA.

Nelson D.L. and Cox M.M., 2008. Lehninger: Principles of Biochemistry 5<sup>th</sup> Ed, W.H Freeman and Company, New York.

Purich D.L, and Allison R.D., 2002 .The Enzymes reference: Academic Press, New York.

Plummer, D.T. 1988. An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

Stryer L., Tymoczko L.J and Berg J.M., 2006. Biochemistry 6<sup>th</sup> Ed, W.H. Freeman and Company, New York.

Taiz, L. and Zeiger, E. 2003. Plant Physiology. Sinauer Associates, Inc., Publishers, Massachusetts. USA.

Voet D. Voet J. G. and Pratt C.W., 2006. Fundamentals of Biochemistry 2<sup>nd</sup> Ed, John Wiley and Sons Inc.

Wilson, K. and Walker, J. 1994. Practical Biochemistry: Principles and Techniques. Cambridge University Press, Cambridge, UK.

Wilson, K. and Goulding, K.H. (Eds), 1996. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London, U.K.

## AB - 403 CYTOGENETICS AND MOLECULAR BIOLOGY

### Unit I: (12 Hours)

History of Cytogenetics; An account on structure, organization and function of prokaryotic and eukaryotic cell system - Bacterial cell wall, nucleus (nuclear membrane, nuclear pore and nucleoplasm), mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, Chloroplast.

### Unit II: (12 Hours)

Mendelian principles; Dominance, segregation, independent assortment, deviation from Mendelian inheritance. Allele, multiple alleles, pseudoalleles, complementation tests. Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Polygenic inheritance, Inheritance of mitochondrial and chloroplast genes, maternal inheritance.

### Unit III: (10 Hours)

Conformation of nucleic acids (A-, B-, Z-, DNA), t-RNA, micro-RNA). Stability, chemical and molecular nature of nucleic acids. Molecular organization of chromosomes; Nuclear DNA content, C-value paradox, Cot curve and its significance, restriction mapping, multigene families and their evolution; In situ hybridization, chromosome microdissection, microcloning.

### Unit IV: (14 Hours)

Molecular aspects of mitosis, meiosis, DNA replication and their regulation. Gene Expression and their regulation. Cancer - molecular and genetic aspects.

### Unit V: (12 Hours)

Mutation - Types, causes and detection, mutant types - lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis. Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications. Flow cytometry, confocal microscopy in karyotype analysis.

### Suggested Reading:

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., and Watson, J.D. 1999. Molecular Biology of the Cell. Garland Publishing Inc., New York.



Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.

Cooper G.M. and Hausman R..E., 2004. The Cell: A Molecular Approach 3<sup>rd</sup> Ed, Sinaur Associates, Inc. Sunderland, Massachusetts.

Gardner E.J., Simmons M.J. and Snustad, D.P., 2003. Principles of Genetics 8<sup>th</sup> Ed, John Wiley and Sons. Inc., New York.

Glick B.R. and Pasternak, 1998. Molecular Biotechnology: Principal and Application of Recombinant DNA 2<sup>nd</sup> Ed, ASM Press, Washington D.C.

Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology: Structure and Function. Jones and Bartlett Publishers, Boston, Massachusetts.

Hartl, D.L. Jones E.W., 2002. Essential Genetics: A Genomic Perspective 3<sup>rd</sup> Ed, Jones and Bartlett Publishers, Sudbury, Massachusetts.

Hughes M.A., 1999. Plant Molecular Genetics, Addison Wesley Longman Limited, England.

Karp G., 2008. Cell and Molecular Biology: Concepts and Experiments, John Wiley and Sons Inc., New York.

Lewin B., Lingappa V.R. and Plopper G., 2007. Cells, Jones and Bartlett Publishers, Sudbury, Massachusetts.

Lewin, B. 2000. Genes VII. Oxford University Press, New York.  
Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell biology (4th Edition). W.H. Freeman and Co., New York, USA.

Malacinski G.M., 2003. Essentials of Molecular Biology 4<sup>th</sup> Ed, Jones and Bartlett Publishers, Inc Sudbury, Massachusetts.

## AB 404 - BASIC MICROBIOLOGY

### Unit I: (14 Hours)

Introduction: Microbes in relation to other organisms; Microorganisms, their special characters and habitat.

History: Historical development of various fields of microbiology; contributions of early microbiologists like Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Alexander Flemming, Ivanowski, Lord Lister, Lazzaro Spallanzani, Paul Ehrlich, Emil Christian Hansen and A.E. Mayer.

### Unit II: (12 Hours)

Morphology and taxonomy: Major groups of microorganisms and their Classification, Nature, structure, reproduction and life-cycle of Bacteria, actinomycetes, Rickettsiae, Mycoplasma.

### Unit III: (10 Hours)

Protozoa, Nature, structure, replication and classification of viruses, classification of fungi, life-cycle of major groups of fungi; heterokaryosis and parasexual cycle.

### Unit IV: (10 Hours)

Bacterial metabolism: sources of energy and nutritional classification of microorganisms - Photolithotrophs, photoorganotrophs, chemolithotrophs, Chemoorganotrophs. Aerobic and anaerobic respiration, Fermentation in yeast and bacteria.

### Unit V: (14 Hours)

Bacterial genetics: Mutation, Genetic recombination - Conjugation, transformation, transduction, gene mapping.

### Suggested Reading:

Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. John Wiley & Sons Inc.

Costa, M.S. Da Ed Microbiology of extreme environment & its potential for biotechnology - 1989.

Collee J.G., Applied Medical Microbiology - 2 edit - 1981.

Freifelder David - 1987. Microbial genetics.

Jacquelyn G. Black, Microbiology (Principles & Explanations) - 4th edition - - 1999.

Larry McKane/Judy Kandel -1996. Microbiology (Essential & Appliances) - 2nd Edition.

Narendra, Microbes & Environment - 1994.

Powar & Dagainawater. General Microbiology - Vol - I - eight edition - 1992 (Reprint - 2000).

Purohit S.S., Microbiology; fundamentals & applications (1991) 4 ed. Stanier Roger Y. - 1993. General Microbiology - 5th ed.

Thomas D. Brock, Michael T. Madigan, 2000. Biology of Microorganisms - 6th edition.

Volk, Wesley. A. - 1984 Basic microbiology - 5 ed.



### **AB 405 PLANT MORPHOLOGY AND TAXONOMY LAB - I**

Algae and Bryophytes: Study of morphology, anatomy and reproductive structures of the types represented by the groups mentioned in the syllabus. Study of fossils.

Taxonomy : Study of local flora. Study of the families listed in the theory part of the syllabus. Identification of plant specimens level using Gamble's flora. Validating the Botanical names using latest literature; herbarium methodologies; Field work, specimen collection, processing and identification.

Field work/ Study Tour.

### **AB 406 - PLANT BIOCHEMISTRY LAB**

Reactions of carbohydrates.

Reactions of proteins & aminoacids.

Precipitation reactions of proteins.

Reactions of non protein nitrogenous substances (NPN) .

Reactions of vitamins.

Identification of unknown proteins.

Identification of unknown carbohydrates.

General scheme for identification of unknown carbohydrates, proteins and Non Protein Nitrogenous (NPN) substances.

Estimation of total sugar.

Effect of time and enzyme concentration on the rate of reaction of an enzyme.

Effect of substrate concentration on the activity of an enzyme. Demonstration of the substrate inducibility of the enzyme nitrate reductase.

### **AB- 407 CYTOGENETICS LAB**

Study of mitosis and meiosis using onion and *Rheo*.

Pollen viability studies using different techniques.

Identification of B-Chromosomes.

Solving problems in genetics.

Study of multiple translocation in *Rheo*.

Orcein and Feulgen staining of the salivary gland chromosomes in *Drosophila*.

#### **AB 408 BASIC MICROBIOLOGY LAB**

Study of morphology of bacteria, simple staining, negative staining; differential staining - Gram staining, acid fast staining. Staining of endospores.

Study of fungal morphology.

Measurement of microbes.

Motility in bacteria.

Biochemical tests - phosphatase, catalase, nitrate reduction.

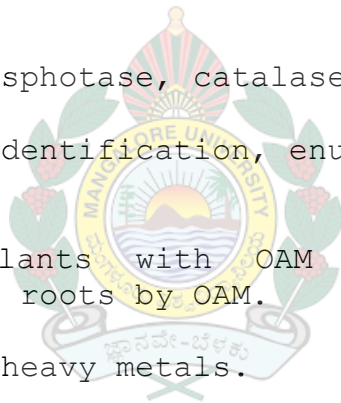
OAM fungi: isolation, identification, enumeration of OAM spores from the soil.

Inoculation of plants with OAM spores, Study of colonization pattern of roots by OAM.

Oligodynamic action of heavy metals.

Antibiotic assay.

Cultivation of mushrooms.



## SEMESTER - II

### AB 451 PLANT MORPHOLOGY AND TAXONOMY - II

#### Unit I: (10 Hours)

Pteridophyta - Distribution and classification of pteridophytes.

Evolution of steles; fossil pteridophytes; Heterospory and the origin of seed habit; Economic importance.

#### Unit II: (14 Hours)

Gymnosperms: Distribution and classification of gymnosperms.

Brief account of the families of Pteridospermales, Lygenopteridaceae, Medullosaceae, Caytoniaceae, Glossopteridaceae; General account of Cycadeoidales and Cordaitales; Structure and reproduction in Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitschiales and Gnetales. Economic importance.

#### Unit III: (8 Hours)

Angiosperm taxonomy: Taxonomic evidence: Chemotaxonomy, Cytotaxonomy, Numerical taxonomy.

#### Unit IV: (14 Hours)

Study of following families with their phylogeny as per Bentham & Hookers system

Rubiaceae, Asteraceae, Sapotaceae, Ebenaceae, Oleaceae, Apocynaceae, Asclepiadaceae, Loganiaceae, Gentianaceae, Boraginaceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Lentibulariaceae, Bignoniaceae, Acanthaceae, Verbenaceae, Lamiaceae, Amaranthaceae, Podostemaceae, Piperaceae, Myristicaceae, Lauraceae, Loranthaceae, Santalaceae, Euphorbiaceae, Moraceae, Urticaceae.

#### Unit V: (14 Hours)

Hydrocharitaceae, Orchidaceae, Musaceae, Zingiberaceae, Liliaceae, Amaryllidaceae, Dioscoreaceae, Commelinaceae, Arecaceae, Pandanaceae, Araceae, Cyperaceae, Poaceae.

#### Suggested Reading:

Bhattacharya B. and B.M. Johre. 1998. Flowering plants - Taxonomy and phylogeny. Narosa Publishing House, New Delhi.

Bhatnagar, S.P. and Moitra, a. 1997. Gymnosperms. New Age International Pvt. Ltd., New Delhi.

Biswas. C., and Johri B.M. 1997. The Gymnosperms. Narosa Publishing House, New Delhi.

Coulter & Chamberlains. 1959. Morphology of gymnosperms. Central Book depot. Hyderabad.

Gurucharan Singh, 1999. Plant systematics - Theory and practice. Oxford and IBH Publishing Co., Pvt Ltd., New Delhi.

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

Heywood V.H., 1976. Botanical Systematics, Academic Press London.

Lawrence, H.M., 1966. Taxonomy of vascular plants. The MacMillan Company, New York.

Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd Edition). Edward Arnold Ltd., London.

Singh G., 1999. Plant Systematics, Oxford and IBH, New Delhi.



## AB 452 - PLANT PHYSIOLOGY

### Unit- I (10 Hours)

Cell differentiation: Internal factors - cytoplasmic, genetic; environmental. 4

Mechanism of ion uptake, transportation and accumulation; Donnan's equilibrium; translocation of solutes. 4

### Unit- II (10 Hours)

Water relations: water requirement, transpiration; factors affecting transpiration, transpiration control and antitranspirants. 4

Mineral Nutrition: Elements found in plants, essential elements, quantitative requirements and tissue analysis, functions, Nutrient deficiency. 6

### Unit III (14 Hours)

Hormones and growth regulators - biosynthesis and mechanisms of action of auxins, gibberellins, cytokinins, ethylene, abscissic acid; application of growth hormones and retardants in agriculture and horticulture; hormone receptors; mechanism of flowering, fruit ripening, abscission, senescence.

### Unit- IV (12 Hours)

Environmental physiology: Response of plants to environmental radiation; allelochemicals and allelopathy; stress physiology - stressful environments, water stress, chemical stress, temperature stress; stress tolerance 8

Chronobiology: Circadian and other rhythms, clock mechanisms, biological clock.

### Unit- V (14 Hours)

Photomorphogenesis: properties of phytochromes, distribution, mode of action, role of phytochromes in seed germination and seedling establishment

Photosynthesis: chloroplasts - structure and function, cyclic and noncyclic photophosphorylation, photolysis, electron transport system; CO<sub>2</sub> fixation; C<sub>3</sub> and C<sub>4</sub> mechanisms, Photorespiration factors affecting photosynthesis.

### Suggested Reading:

Buchanan, B.B., Gruissem, W. and Jones, R.L. 2007. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.



Burgess, J. 1989. An introduction to plant cell development. Cambridge University Press, Cambridge.

Devlin, R. and F.H. Whiteman 1986. Plant physiology. CBS publishers and distributors, New Delhi.

Hemantaraman A., 2007. Environmental Physiology, Scientific Publisher, India.

Hale M.G. and D.M. Orcutt 1987. The physiology of Plants under stress. A wiley - interscience publication. New York.

Hopkins, W.G. 2005. Introduction to Plant Physiology. John Wiley & sons, Inc., New York, USA.

Khan N.A. and Singh S., 2008. Abiotic Stress and Plant Responses, I.K. International Publishing House Pvt Ltd, New Delhi.

Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones Springer-Verlag, New York, USA.

Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory Manual: Springer-Verlag, Berlin, New York.

Noggle, G.R. and G.J. Fritz 1986. Introductory plant physiology. CBS Publishers and distributors, New Delhi.

Scott P., 2008. Physiology and Behavior of Plant, Jhon Wiley and Sons Ltd, USA.

Srivastava L.M, 2005. Plant Growth and Development and Environment, Academic Press, California.

Salisbury, F.B. and Ross, C.W. 2001. Plant Physiology. Wadsworth Publishing Co., California, USA.

Taiz, L. and Zeiger, E. 2003. Plant Physiology Sinauer Associates, Inc., Publishers, Massachusetts. USA.

Wilkins, M.B. 1989. Advanced plant physiology. Longman Scientific and Technical, England.

## AB - 453 PLANT BREEDING

### Unit I (12 Hours)

History, objectives, Present Status and Future Prospects of plant breeding; Plant breeding as both an art and science. Modes of Reproduction - asexual and sexual. Determination of mode of reproduction and pollination in a species. Mechanism of pollination control. Morphological Contrivances promoting allogamy and autogamy, Self-incompatibility and male sterility.

### Unit II: (12 Hours)

Centers of Origin; Domestication - Plant Introduction - history and procedure; Germplasm Collection - types, purpose, maintenance, evaluation, achievements, merits and demerits. Continuous variation and its significance - qualitative traits and discrete variation, quantitative traits and continuous variation, polygenes and polygenic inheritance.

### Unit III: (12 Hours)

Nature of gene action and components of genetic variation; Genotype and environment interaction and adaptation. Methods of selection, population improvement, hybrids and synthetic varieties.

### Unit IV: (12 Hours)

Breeding in self-pollinated crops - hybridization - History, objectives, types procedures, consequences and achievements. Pure lines - origin of variation, Pure line theory, effect of self-pollination on the genotype and achievements in breeding self-pollinated crops; Heterosis - homozygous and heterozygous balance.

### Unit V: (12 Hours)

Breeding for disease resistance - History, mechanism of variability in pathogens, methods of breeding for disease resistance; Polyploidy - types, applications and its limitations.

### Suggested Reading:

Allard R.W., 1960. Principles of Plant Breeding, John Wiley Publication.

Atherly, A.G., Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, For Worth, USA.

Cochran, G.W. and Cox, M.G. (1987) Experimental Design. John Wiley & Sons Inc.

Chaudhari H.K., 1974. Elementary Principles of Plant Breeding, Oxford and IBH, New Delhi.

Hegberg and Arne., 1961. Mutation and Polyploidy in Plant Breeding, Heinemann Publication, London.

Khush, G.S. 1973. Cytogenetics of Aneuploids. Academic Press, New York, London.

Mauro Ed G. P., 1988. Sexual Reproduction in Higher Plants, Springer Verlag, New York.

Sharma J.R. 1994. Principles and practice of Plant Breeding. Tata McGraw Hill Publishing Co. Ltd. New Delhi. pp 599.

Winer, B.J. 1971. Statistical Principles in Experimental Design Second edition. McGraw-Hill Kogakusha Ltd. New Delhi. pp. 907.



## AB 454 - APPLIED MICROBIOLOGY

### Unit I: (10 Hours)

Microbial nutrition: Essential microbial nutrient elements and their role, vitamins and growth factors  
Culture: cultivation of aerobic and anaerobic bacteria.

### Unit II: (14 Hours)

Microbial toxins: Mycotoxins and bacterial toxins; food poisoning and food infections.  
Growth: growth, growth phases, growth curve, synchronous growth, measurement of growth.  
Factors affecting growth and death - physical and chemical.

### Unit III: (12 Hours)

Plant microbe interactions: Symbiosis, Mutualism, commensalism, parasitism, Ecto and endomycorrhiza - Arbuscular Mycorrhiza.

### Unit IV: (10 Hours)

Normal microflora of man, pathogenic flora, entry of pathogens and colonisation; exotoxins, enterotoxins, endotoxins, virulence.

### Unit V: (14 Hours)

Immunology: Cellular and humoral defense system, phagocytosis, cells of immune system; Immunogen, and Antibody - structure of immunoglobulins.

Types of immunity, antibody production, primary and secondary response; antigen-antibody reaction - agglutination, precipitation, complement, complement fixation; Immunological tests - precipitation test, Immunodiffusion, Immuno electrophoresis, Immunofluorescence, Radio immunoassay; antibody tests - ELISA, Western blotting; Monoclonal and polyclonal antibodies.

### Suggested Reading:

Ahmed M and Basumatary S.K., 2006. Applied Microbiology M.J.P. Publishers, Chennai, India.

Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. John Wiley & Sons Inc.

Black J.C., 2005. Microbiology: Principle and Exploration 6<sup>th</sup> Ed, John Wiley and Sons Inc, USA.

Collee J.G., Applied Medical Microbiology - 2 edit - 1981 -

Elgert K.D.,1996. Immunology: Understanding Immunosystem, Wiley -Liss, New York.

Kalaichetvans P.T. and Pandi I.A., 2007. Bioprocess Technology M.J.P. Publishers, Chennai, India.

Kuby J., 1993. Immunology 2<sup>nd</sup> Ed, W.H. Freeman and company, New York.

Murray R.R, Resenthal K.S, Kobayashi G.S and Pfaller M.A., 1994. Medical Microbiology 3<sup>rd</sup> Ed, Mosby, New York.

Moat A.G, Foster J.W and Spector M.P., 2002. Microbial Physiology Wiley - Liss, Canada.

Pelezar, Michael J. 4th ed. - New Delhi; Tata Mcgraw Hill 1983  
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## **AB- 455 PLANT MORPHOLOGY AND TAXONOMY LAB - II**

Pteridophytes and Gymnosperms: Study of morphology, anatomy and reproductive structures of representative types of the groups.

Study of fossils.

Angiosperm Taxonomy: Identification of plants pertaining to the families mentioned in the syllabus. Construction of dichotomous keys for family, genus, and species.

Preparation of ten herbarium specimens of common plants.

Field work / study tour.

## **AB 456 - PLANT PHYSIOLOGY LAB**

Separation of amino acids by thin layer chromatography (TLC).

Separation of Amino acids by paper chromatography.

Studies on the factors affecting rate of respiration in plants.

Effect of phytohormones on plant development.

Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids.

To determine the chlorophyll a/chlorophyll b ratio in C<sub>3</sub> and C<sub>4</sub> plants.

Extraction of seed proteins.

Preparation of standard curve of protein (BSA) and estimation of the protein content of plant materials.

Physiological adaptations in plants - xerophytes, mesophytes, hydrophytes.

Determination of water potential using scholander pressure chamber.

Estimation of vitamin C (Ascorbic acid) in plants.

Determination of diffusion pressure deficit.

Determination of stomatal frequency, stomatal index and the area of stomatal aperture.

## **AB - 457 PLANT BREEDING AND BIOMETRICS LAB**

Study of floral biology and pollination mechanism.

Techniques in Hybridization.

Procedures of emasculation in plants.

Grafting, budding and layering.

Induction of polyploidy using colchicines.

Biometrics: Definition of 'Statistics'; its usages.

Construction of frequency tables. Frequency graphs and their uses. Measures of Central tendency - mean, median and mode.

Measures of dispersion - Range, standard deviation. Coefficient of variation.

Population versus sample - Need and objectives of sampling.

Methods of simple random sampling, stratified sampling, cluster sampling and sub sampling and their application in field research. Non-parametric tests - Sign test, Wilcoxon test, Mann-Whitney test, Kruskal and Wallis test.

Distribution of sample mean; standard error and its uses.

Scatter diagram, simple correlation and regression; multiple correlation.

Basic concepts of probability. Theoretical distributions - Binomial, Poisson and Normal.

Statistical inference - need and meaning in biological research. Normal, t, Chi-square and F-tests.

Analysis of variance - meaning and uses in research. Basic principles of experimental designs. Completely randomised design and randomised block design. Comparison of pairs of treatments using t test.

## **AB 458 APPLIED MICROBIOLOGY LAB**

Bacterial growth - preparation of growth curves.

Methods of sterilization - Dry, Wet and Filter sterilization.

Preparation of media and isolation of fungi, bacteria and actinomycetes from different habitats and their enumeration.

Studies on nitrogen fixing bacteria - Isolation and culture of symbiotic Nitrogen fixing bacteria and inoculation of legumes.

Isolation and culture of nonsymbiotic nitrogen fixing bacteria.

Tests for purity of drinking water. Presumptive, confirmed and completed tests.

Immunology - precipitation & Agglutination tests.

Bacteria in milk, curds etc.

Alcohol fermentation by yeast.





## SEMESTER III

### AB 501 - Choice based course

#### Medicinal Plants

##### Unit I: (14 Hours)

Plant classification - Broad outline of major groups and ranks of taxa, Plant Nomenclature- Common names, Binomial nomenclature, IUBN- brief outline of methods in nomenclature; Typification.

Herbarium- Methods of collection, processing of herbarium specimens; Major herbaria of the world, Botanical Survey of India- brief outline of its organization and its role and significance.

##### Unit II: (12 Hours)

Medicinal plants - system of herbal medicine, threatened medicinal plants- Threats, various approaches to conservation - *in-situ* and *ex-situ*; MPCA, Biosphere reserves, National parks, Sacred grooves, CITES, IUCN categories of plant, Brief account of Biodiversity Act.

##### Unit III: (10 Hours)

Ethnobotany: Basic approaches to study the traditional knowledge on plant use. Collection methods, field methods and studying of Herbarium specimens and folklore; verification of data, Aesthetic value.

##### Unit IV: (10 Hours)

Plants as medicine: Drugs of botanical origin. Medicinal properties of important local plants, Nutraceuticals Bioprospecting, Biopiracy.

Intellectual property Rights: Forms of protection, Patents, Cryopreservation, Trademarks, Trade secrets, Designs, Breeders rights, Farmer's rights, Plant variety protection.

##### Unit V: (14 Hours)

Cultivation potential of important medicinal plants Agroclimatic requirements, propagation, Transplanting and aftercare of the following medicinal plants.

*Acorus calamus*

*Adathoda zeylanica*

*Andrographis paniculata*

*Asparagus racemosus*

*Azadirachta indica*

*Centella asiatica*

*Cissus quadrangularis*

*Eelipta alba*

*Piper longum*  
*Plumbago zeylanica*  
*Rauwolfia serpentina*  
*Saraca asoca*  
*Coscinium fenestratum*  
*Strobilanthus citiatus*  
*Nothopodytis nimmoniana*  
*Zingiber officinale*  
*Ochreanauclea missionis*  
*Vinca rosea*  
*Aristolochia indica*  
*Gloriosa superba*  
*Emblica officinalis*  
*Embelia ribes*  
*Hydnocarpus pentandra*  
*Cinnamomum suphuratum*  
*Thottea siliquosa*

**Suggested Reading:**

Agarwal.S.S.M.Paridhavi (2007) Herbal Drug Technology, University press, Hyderabad.

Bennet, S.S.R. 1979. An Introduction to Plant nomenclature. International Book Distributors. 9/3. Rajpur Road, Dehra Dun 248001. India.

Davis, P.H., V.H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd Ltd., Tweeddale Court, Edinburgh.

Heywood V.H., 1976. Botanical Systematics, Academic Press London.

Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd Edition). Edward Arnold Ltd., London.

Sumy, Ved & Krishnan (2000) Tropical Medicinal Plants, FRLHT, Bangalore.

## AB 502 - PLANT BIOTECHNOLOGY - I

### Unit I (6 Hours)

Origin, history of plant biotechnology, general scope of plant biotechnology.

Laboratory organization, basic principles of cell and tissue culture.

### Unit II (12 Hours)

Culture media: types of media, preparation, sterilization, role of macronutrients, micronutrients, organic nutrients, growth regulators and gelling agents, undefined supplements, different carbon sources used in tissue culture media.

### Unit III (14 Hours)

Micropropagation: selection of explants, totipotency, major steps involved in micropropagation, induction of callus, meristem culture, embryo culture, factors affecting *in vitro* stages of micropropagation, applications and limitations of micropropagation. Cytodifferentiation and organogenesis, factors involved in vascular tissue differentiation and organogenesis. Somatic embryogenesis, synthetic seeds.

### Unit IV (14Hours)

Cell suspension culture: isolation of cells, types of suspension cultures - batch, continuous cultures, synchronization, assessment of growth and viability in suspension culture, techniques involved in culturing single cells, factors affecting single cell culture. Plant cell reactors- selection, types of bioreactors, production of secondary metabolites, problems associated with secondary metabolite production.

### Unit V (14Hours)

Haploid production: Androgenic haploids - anther culture, microspore culture, factors responsible for the success of androgenesis, process involved, ploidy level, significance of haploids, problems involved in haploid culture. Gynogenic haploids - explants, pre - treatment, factors responsible for gynogenesis and practical importance of gynogenesis.

Triploid production: callusing, culture medium, physical factors, organogenesis, factors responsible for shoot bud differentiation and applications of endosperm culture.

### Suggested Reading:

Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture: Theory and practice. Elsevier Science Publishers, New York, USA.

Chawla H.S., 2004 Plant Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd

Chrispeels, M.J. and Sadava, D.E. 1994. Plants, Genes and Agriculture, Jones and Bartlett Publishers, Boston, USA.

Collins, H.A. and Edwards, S. 1998. Plant Cell Culture. Bios Scientific Publishers, Oxford, UK

Giri C C and Giri A., 2007. Plant Biotechnology Practical Manual, I K International Publishing House Pvt Ltd.

Khanna V K., 2003. Plant Tissue Culture Practicals, Kalyani, 2<sup>nd</sup> Ed, U.P.

Kumar K, 2004. An introduction to Plant tissue culture, New Central Book Agency (P) Ltd

Peter K V, Keshavachandran R., 2008. plant Biotechnology: Methods in Tissue Culture and Gene Transfer, Universities Press, Hyderabad.

Purohit S.S. 2000. Bio-fundamentals and applications, Agrobios, Jodhpur

Purohit S.S.-1999. Agricultural Biotechnology, Agro Botanical Publ. Bikaner

Ramavath K G., 2004. Plant Biotechnology, Chand Publication, New Delhi.

Reinert, J. 1982. Plant Cell and Tissue Culture: A Laboratory Manual. Narosa Publishing House, New Delhi.

## AB 503 PLANT PATHOLOGY - I

### UNIT I (12 Hours)

History: History of plant pathology with reference to important diseases of crop plants. Plant diseases and World Crop production, Concept of plant diseases, Types of plant diseases, Identification of plant diseases: Koch's rules.

### UNIT II (12 Hours)

Seed born diseases and Transmission: Pollination, fertilization, embryogenesis, morphology and physiology in relation to seed infection. Seed-borne pathogens and their importance - viruses, bacteria, fungi and nematodes; seed infection and contamination, seed to plant transmission, establishment of infection and course of disease; factors affecting establishment and course of disease - pathogenic, host, physico-chemical and biotic.

### UNIT III (12 Hours)

Important Plant diseases: General aspects of plant diseases caused by viruses, mycoplasma, bacteria, fungi, protozoa, nematodes, parasitic angiosperms - symptoms, etiology, life cycle, transmission etc., Non-parasitic diseases.

### UNIT IV (12 Hours)

Plant disease cycles, Epidemiology and Forecasting: Plant disease cycles and Plant disease triangle, human and time factors.

Factors affecting plant disease epidemics, measurement, classification, pattern and development of epidemics, forecasting plant disease epidemics.

### UNIT V (12 Hours)

Host-parasite interactions: Pathogenic factors in disease development - Mechanism of penetration and establishment - prepenetration, penetration and infection phases; invasiveness - biotrophic and necrotrophic pathogens; - production of enzymes, toxins - specific and non specific toxins and their role, growth regulator and polysaccharides; effect of infection on physiological functions of host, translocation of water and mineral nutrients, organic nutrients, respiration and permeability, transcription and translation.

### Suggested Reading:

Ainsworth, G.C. 1981. Introduction to the history of Plant Pathology.

Agrios, N. 1997. Plant Pathology, Academic Press, NewYork.

Agnihotri, V.P., Sarbhay, A.K., Singh, D.V., 1997. Management of threatening plant diseases of National Importance.

Bedell P.E. (1998) Seed Science and and technology. New Delhi - Allied PP 346.

Callow, J.A., (Ed.) 1983. Biochemical plant pathology. John Wiley & Sons.

Chester, Starr, K., 1994. Arihant Plant diseases - Jaipur.

Dhingra, D. 1993. Basic Plant Pathology methods - Delhi CBS.

Fungal pathogenesis in plants and crops.

John A. Lucas - 3rd Ed. 1998. Plant Pathology & Plant Pathogens.

Mahadevan. A. Post infectious defence mechanisms - New Delhi (Today & Tomorrow, 1991).

Maude, R.B (1996) Seed borne diseases and their control. Wallingford : Cab International, Lowman PP 280.

Paul Neergaard (1988). Seed Pathology Vols. I & II. Published by the Macmillan Press Ltd. Houndmills. Basingstoke, Hampshire

Rangaswami, Mahadevan, A. 2001. Diseases of crop plants in India. Prentice Hall of India, Pvt. Ltd., New Delhi.

Singh, R.S. 1990. Plant diseases - 6th ed. New Delhi. Oxford & IBM.

Vidhyasekaran, P. 1997. Fungal Pathogenesis in plants and crops. (Molecular Biology and host Defense mechanisms), Marcel Dekker Inc.

Vidhyasekaran, P. - 1990. Basic research for crop diseases Management - Daya Pub., Delhi.

## AB 504 - ECOLOGY AND ENVIRONMENT

### Unit I: (10 Hours)

Ecosystems: Introduction, trophic levels, Foods webs, Energy flow, Primary and secondary production, nutrient cycles: C, N, P and S.

Soil : Classification, types of soil, soil profile.

Ecological succession: Types and causes, climax community, island Biogeography.

### Unit II: (14 Hours)

Autecology: Scope, method of study Systematic position, flowering, pollination - types, adaptations, plant-pollinator interaction, seed output, germination, viability and dormancy, reproductive capacity, seed dispersal, seedling growth, vegetative growth, phenology.

Genecology: Ecological amplitude, ecads, ecotypes, ecospecies; habitat, ecological niche.

### Unit III: (10 Hours)

Synecology (Community ecology): Major plant communities: characters used in the study of community structure - analytical and synthetic characters. Methods of study of communities - floristic, physiognomic and phytosociological, methods - quadrat, transect, sampling plots and point methods, gradient analysis, ecotone, edge effect.

Diversity indices- Simpson's index, Shannon-Weiner's index, alpha, beta and gamma diversity, Jaccard's index.

### Unit IV: (10 Hours)

Population ecology: Abiotic factors that affect speices distribution patterns, characteristics of population - density, natality, mortality, age distribution, biotic potential, growth forms, fluctuations and dispersal; population structure - dispersal, aggregation, intraspecific interactions in populations; population growth - life tables, deterministic models, stochastic models, causes of population change - key factor analysis, density dependence, spreading the risk, spatial phenomena.

### Unit V: (16 Hours)

Global warming: Green house effect, causes and consequences. Ozone depletion- causes and consequences.

Air & water pollution - major pollutants, their source, permissible limits - and control. Radioactive pollution: Ionising radiation, disposal of radioactive waste, Nuclear accidents.

### **Suggested Reading:**

Hunter JR. M. L., 1999. Maintaining Biodiversity in Forest Ecosystem, Cambridge University Press.

Harold, W., Hocker. Jr. 1979. Introduction to Forest Biology, John Wiley and Son's Publication, Toronto.

Kormondy, E.J. 1996. Concepts of Ecology. prentice-Hall of India pvt. Ltd., New Delhi.

Ludwig, J.A. and Reynold, J.F. 1988. Statistical Ecology. Wiley, New York.

Narasaiah M. L., 2005. Biodiversity and Sustainable Development, Discovery Publishing House, New Delhi.

Robert S. B. Ronald A., Gecsey D.S.G, Sayler G., 1988. Technique in Microbial Ecology, Oxford University, Press NewYork.

Sinha R. K., 2008. Biodiversity Global Concerns, Commonwealth Publishers, New Delhi.

Tondon P, Abrol Y. P, Kumaria S., 2007. Biodiversity and its significance, I K International, New Delhi.

Tewari D. N., 1995. Western Ghats Ecosystem, International Book Distributor, Dehra Dun.

Odum, E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.

Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.

Peter D. Stiling, 1992. Introductory Ecology. Prentice Hall, Englewood Cliffs, NJ 07632

Smith, R.L. 1996. Ecology and Field Biology. Harper Collins, New York.

Smith, R.L. 1996, 1990. Ecology and Field Biology. Harper Collins, New York.



### **AB 505- Medicinal plants Lab**

Identification and Technical details of Medicinal Plants.

Qualitative analysis of Medicinally important compounds.

- i. Alkaloids
- ii. Flavanoids
- iii. Phenolics

Quantitative estimation of Medicinally important compounds.

Screening for antibacterial/ antifungal activities of plant extracts.

Visit to Ayurvedic pharmacy and reporting.

### **AB 506 - PLANT BIOTECHNOLOGY LAB -I**

Preparation of culture media.

Effect of media on callus development / morphogenesis / embryogenesis.

Effect of growth regulators on callus development / morphogenesis / embryogenesis.

Callus induction, organogenesis - shooting, rooting, hardening from different explant sources.

Embryo culture.

Anther culture.

Preparation of synthetic seeds.

Cell suspension culture.

Hemocytometer cell counting.

% viability of cells in suspension.

Analysis of cell growth in suspension culture (fresh weight and dry weight method).

Detection of secondary metabolites in callus using PC / TLC  
Estimation of phenolics.

Qualitative detection of steroids in cells.

Estimation of chlorophyll in cultured cells.

### **AB 507 PLANT PATHOLOGY LAB - I**

Study of symptoms of important plant diseases caused by bacteria, fungi, nematodes, viruses and mycoplasma on cereals, vegetables, fruit crops, plantation crops & wild plants - Symptoms etiology and morphology.

Histopathology - sectioning & staining the tissues affected by different pathogens.

Seedling symptom test.

Detection of seed-borne bacteria.

Detection of seed-borne nematodes.

Growing on test.

Isolation of Pathogens and inoculation.

Study of Plant disease enzymes.

Production of mycotoxin.

Isolation of microbes antagonistic to fungi and bacteria from the soil.

### **AB 508 - ECOLOGY & ENVIRONMENT LAB**

Morphology and Anatomy of plants in relation to habitats - xerophytes, mesophytes, hydrophytes, halophytes and psammophytes.

Preparation of ombrothermic diagrams.

Calculation of Evapotranspiration.

Population studies by transects and quadrats.

Soil analysis: Soil grading, Soil moisture, water holding capacity, porosity, pH and bulk density.

Estimation of organic carbon, sulphate, phosphate, nitrogen, calcium, sodium, potassium.

Water analysis: Salinity, alkalinity, Hardness, Chlorine demand, Residual Chlorine.

Determination of dissolved oxygen and CO<sub>2</sub> in different water samples.

Field work/ Study tour.

## SEMESTER IV

### AB 551- SEED TECHNOLOGY

#### UNIT I (12 Hours)

History and Seed processing:

History and importance of seed Technology,

Seed dormancy and recalcitrance. Inter-relationships of seed moisture, relative humidity and temperature

Importance, equipments used in preparation of seed for processing - threshing, shelling, debearding and scalping. Seed drying: Importance, drying methods, types of driers, drying characteristics of seeds,. Seed cleaning, drying and grading: Types of cleaners / graders, grading of seeds, specification and rejection of lot, bagging.

#### UNIT II (12 Hours)

Seed Health Testing: Salient features of seed health, objectives, Sampling, purity analysis, moisture determination, germination, viability, vigour; incubation tests, growing-on test, bioassays and biochemical procedures, factors affecting the test results: assessment of seed-borne inoculum.

#### UNIT III (12 Hours)

Seed treatment and storage: Importance, common pesticides used types of seed treaters, analysis of treated seeds and assay of protectants. Types of storage - insulation, air conditioning, humidification and fumigation, Importance of seed storage losses.

#### UNIT IV (12 Hours)

Seed certification and quarantine: quarantine regulations, field and seed inspection; seed legislation and seed law enforcement.

#### UNIT V (12 Hours)

Seed production and marketing: General Principles of seed production, collection and handling. Management of seed production: Location of seed production, cropping, selection of cultivars, cultural practices, chemical protection of seeds, protective inoculation, precautions to be taken at harvesting. Production of seeds of important crops, management of seed marketing, marketing structure, transport, storage, pricing. Hybrid seeds, transgenic seeds, breeders seeds, foundation and certified seed production, seed quality certification.

#### Suggested Reading:

Aitchinson Jean (1996). Seeds Speech Language origin and evolution. Cambridge, U.K.

Agarwal V.K. & Sinclair J.B. (1987) Principles of Seed pathology Vol I & II CRC Press Inc. Boca Raton, Florida, USA.

Agarwal R.L. (1998) Seed Technology. Oxford & IBH Publishing Co. Pvt Ltd. New Delhi.

Bedell P.E. (1998) Seed Science and technology-Allied, New Delhi.

Karivaradaraaju, T.V., Vanangamudi, K., Umarani, R., Bharathi, A., Surendran, C., Balali S. (1999) Tamil Nadu Agricultural University Coimbatore, "A Treatise on Tree Seed Technology".

Khare (2000) Seed technology, Scientific Publishers, Jodhpur.

Kozlowski. TT. (1971) Seed Biology Growth and Development of Trees. Volumes I & II Insects and seed collection, storage, testing and certification - Vol III. Academic Press Inc. Ltd. London.

Maude, R.B. (1996) Seed borne diseases and their control. Wallingford: Cab International, London.

Mcdonald (1992) Seed Science and technology: Laboratory manual, Scientific publishers. Jodhpur.

Paul Neergaard (1988). Seed Pathology Vols. I & II. Published by the Macmillan Press Ltd. Houndmills. Basingstoke, Hampshire.

Stewart, Remington John (1991) Seed testing. Printwell, Jaipur.

Vanangamudi, K., Bharathi, A., Natesan, P., Jerlin, R., Thiyagarajan, T.M., Kannaiyan, S., (2001) Tamil Nadu Agricultural University Coimbatore. "Recent Techniques and participatory Approaches on Quality Seed Production".

## AB 552 - PLANT BIOTECHNOLOGY - II

### Unit I: (12 Hours)

Protoplast isolation and fusion: different methods of protoplast isolation, culture techniques, protoplast developments. Different methods of protoplast fusion, selection, characterization of hybrids, cybrids, applications and limitations of somatic hybridization.

Somaclonal variation: somaclonal variants, isolation of somaclonal variants, basis for somaclonal variation, applications of somaclonal variation.

### Unit II: (10 Hours)

Germplasm storage and cryopreservation: long term storage - plant materials, pre - freezing treatments, cryoprotectants, freezing, thawing, reculture, checking the efficiency of cryopreservation. Comparison of long term storage with short or medium term storage.

### Unit III: (14 Hours)

Genetic engineering: transposable elements in bacteria - IS elements, composite transposons, complex transposons, transposable elements in eukaryotes - classification, class I, class II elements, transposon gene tagging.

Gene isolation: isolation of gene of interest, marker assisted selection - morphological markers, biochemical markers, molecular markers - non PCR based (RFLP), PCR based (PCR, RAPD, AFLP, SSR, SPAR, STMs, SCARs, CAPS), cloning, construction of genetic and physical maps, chromosome walking, FISH, gene testing using transformation and complementation tests.

### Unit IV: (12 Hours)

Gene transfer methods: Direct gene transfer - microinjection, electroporation, chemical transformation, liposome mediated, ultrasound mediated, calcium phosphate coprecipitation, particle bombardment method. Advantages and disadvantages of direct gene transfer. Agrobacterium mediated gene transfer - Ti plasmid, co-integrate and binary vector, culturing, advantages and disadvantages. Viral vector mediated gene transfer - Cauliflower mosaic virus mediated and Gemini virus mediated, advantages and disadvantages.

### Unit V: (12 Hours)

Transgenics in crop improvement: resistance to biotic stress - insect resistance, virus resistance, disease resistance. Resistance to abiotic stress - herbicide resistance, metal tolerance. Transgenics for improved quality - storage and male sterility. GMOs, problems, safety, and public acceptance of cultivating transgenic plants.

Biodegradation, bioremediation, biofertilizer, production of single cell proteins.

**Suggested Reading:**

Bhojwani S.S. and Razdan M.K., 2004 Plant tissue culture, Panima Publishing Corporation, Delhi.

Chawla H.S., 2004 Plant Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd.

Gustafson, J.P. 2000. Genomes, Kluwer Academic plenum press, Newyork.

Ignacimuthu, S.J. 1997. Plant Biotechnology, Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.

Old, R.W. and Primrose, S.B. 1989. Principles of Gene Manipulation, Blackwell Scientific Publications, Oxford UK.

Primrose, S.B. 1995, Principles of Genome Analysis. Blackwell Science Ltd., Oxford, UK.

Purohit S.S. 2000. Bio-fundamentals and applications, Agrobios, Jodhpur.

Purohit S.S.-1999. Agricultural Biotechnology, Agro Botanical Publ. Bikaner.

Reinert, J. 1982. Plant Cell and Tissue Culture: A Laboratory Manual. . Narosa Publishing House. New Delhi.

Scheppler J.A., Cassin, E.P. and Gambier R.M. 2000. Biotechnology explorations, ASM press, Washington. DC.

Smith E. 1996. Biotechnology, Cambridge press, U.K.

Smith, R.M. 2000. Plant tissue cluture, Techniques and experiments, Academic press, Newyork.

Treshan 1990. Biotechnology, Wiley Eastern, New Delhi.

## AB 553 - PLANT PATHOLOGY - II

### UNIT I (12 Hours)

Elicitor and signal transduction: Early Recognition process of host and pathogen, types of Elicitors, Production of Elicitor, Elicitor Receptor concept, Signal transduction: Intra- cellular and Systematic signal transduction, systemic Acquired Resistance.

### UNIT II (12 Hours)

Host - defence mechanisms: structural and chemical defence, Hypersensitive reaction, Active oxygen radicals, Lipoxygenases, Pathogen related proteins, Phytoalexins, Phenolic compounds, Polyphenol oxidases, plantibodies, Detoxification of pathogen toxins.

### UNIT III (12 Hours)

Genetics of host-parasite interaction: genes and variability in pathogens; genetics of virulence and resistance, horizontal and vertical resistance, Gene to Gene concept. Breeding of resistant varieties.

### UNIT IV (12 Hours)

Study of Plant Diseases: Study of Important Diseases on fruits, vegetables, cereals and plantation crops.

### UNIT V (12 Hours)

Control of Plant Diseases: Physical, chemical and biological; Cultural practices; integrated pest management; plant quarantine Crop certification.

### Suggested Reading:

Ainsworth, G.C. 1981. Introduction to the history of Plant Pathology.

Agrios, N. 1997. Plant Pathology, Academic Press, NewYork.

Agnihotri, V.P., Sarbhay, A.K., Singh, D.V., 1997. Management of threatening plant diseases of National Importance.

Callow, J.A., (Ed.) 1983. Biochemical plant pathology. John Wiley & Sons.

Chester, Starr, K., 1994. Arihant Plant diseases - Jaipur.

Dhingra, D. 1993. Basic Plant Pathology methods - Delhi CBS.

Dordrecht; 1995. Induced resistance to disease in plants.

Fungal pathogenesis in plants and crops. John A. Lucas - 3rd Ed. 1998. Plant Pathology & Plant Pathogens.

Mahadevan. A. Post infectious defence mechanisms - New Delhi (Today & Tomorrow, 1991).

Rangaswami, Mahadevan, A. 2001. Diseases of crop plants in India. Prentice Hall of India, Pvt. Ltd., New Delhi.

Singh, R.S. 1990. Plant diseases - 6th ed. New Delhi. Oxford & IBM.

Vidhyasekaran, P. 1997. Fungal Pathogenesis in plants and crops. (Molecular Biology and host Defense mechanisms), Marcel Dekker Inc.

Vidhyasekaran, P. - 1990. Basic research for crop diseases Management - Delhi: Daya Publ.





## **AB 554 - BIODIVERSITY AND PLANT CONSERVATION**

### **Unit I: (12 Hours)**

Phytogeography : Phytogeographical regions of the world, centre of origin of plants, migration routes, Vavilov's theory - vegetation types of India with special reference to the Western Ghats.

### **Unit II: (12 Hours)**

Biodiversity: Concept, Diversity at the levels of genes, species, higher taxa; Levels of diversity among different taxonomic groups. Megadiversity regions.

### **Unit III: (10 Hours)**

Endemism: Definition, types of endemics, causes of endemism. An account of endemic plants of Western Ghats, Biological hotspots.

Role of biodiversity in ecosystem functions and stability economic and aesthetic values; an account of medicinal and timber yielding plants, NTFP.

### **Unit IV: (14 Hours)**

Threats to biodiversity, speciation and extinction; IUCN classification of threatened plants, introduction of exotic species

Conservation methods:- Ex-situ and In-situ conservation, protected ecosystems - biosphere reserves, national parks, game sanctuaries, botanical gardens, Medicinal plant conservation areas (MPCA).

Environmental movements: Global and regional, Earth summit, Man and biosphere programme.

### **Unit V: (12 Hours)**

Environmental laws - Indian Forest conservation Act, Biodiversity bill, Community Biodiversity register, CITES (Convention on international trade in endangered species).

Ecological management : Sustainable development, biological indicators. environmental impact assessment (EIA). Carrying capacity, ecological restoration; afforestation, green belt, social forestry, agroforestry. Remote sensing and forestry.

### **Suggested Reading**

Ahmedullah, M. and M.P. Nayar, 1986. Endemic plants of the Indian region. Vol 1. Botanical Survey of India.

Champion, H.G. and S.K. Seth, 1968. A revised survey of the forest types of India.

Harold, W., Hocker. Jr. 1979. Introduction to Forest Biology, John Wiley and Son's Publication, Toronto.

Hunter JR. M. L., 1999. Maintaining Biodiversity in Forest Ecosystem, Cambridge University Press.

Jain, S.K & Mehra K.L. 1983. Conservation of tropical plant resources BSI. Calcutta.

Jain S.K. & R.R. Rao. 1983. An assessment of threatened plants of India. BSI Calcutta.

Longman, K.A. & Jenik, J. 1987. Tropical forests and its environment. English language book society.

Narasaiah M. L., 2005. Biodiversity and Sustainable Development, Discovery Publishing House, New Delhi.

Nayar & Sastry 1987. Red data book of Indian Plants. Vol 1-3 BSI Pub. Calcutta.

Pascal J.P. 1988. Wet evergreen forests of the Western Ghats of India. Institut Francais de Pandichery.

Peter D. Stiling 1992. Introductory Ecology Prentice Hall.

Puri G.S., V.M. Meher-Homji, R.K. Gupta and S. Puri 1980. Forest ecology (2nd edn.) Vol. 1. Phytogeography and forest conservation. Oxford and IBH.

Puri G.S., V.M. Meher-Homji, R.K. Gupta and S. Puri 1989. Forest ecology (2nd edn.) Vol.2 - Plant form, diversity, communities and succession. Oxford and IBH.

Tondon P, Abrol Y. P, Kumaria S., 2007. Biodiversity and its significance, I K International, New Delhi.

Tewari D. N., 1995. Western Ghats Ecosystem, International Book Distributor, Dehra Dun.

### **AB 555 SEED TECHNOLOGY LAB**

Field inspection.  
Seed sampling.  
Seed anatomy and morphology.  
Inspection of dry seed samples.  
Purity analysis.  
Studies on viability of seeds.  
Seed germination and vigour.  
Seed moisture determination by different methods.  
Water activity determination of seed.  
Detection of seed-borne fungi:  
    Blotter method,  
    Agar plate method,  
    Deep freezing blotter method,  
    Component plating,  
    Embryo extraction method.  
    Growing on test.  
Chemical seed treatment.  
Study of efficacy of fungicides.  
Study of storage structures.

### **AB 556 - PLANT BIOTECHNOLOGY LAB - II**

Isolation of plant cells by mechanical and enzymatic methods.  
Protoplast culture.  
Cryopreservation technique.  
Checking the efficiency of cryopreservation.  
Isolation of DNA.  
Isolation of RNA.  
Estimation of DNA - Diphenylamine method.  
Estimation of RNA by Orcinol method.  
Spectrophotometric method for the estimation DNA.  
Spectrophotometric method for the estimation RNA.  
Spectrophotometric method for the estimation Proteins.  
Preparation of competent cells and bacterial transformation.  
Agarose gel electrophoresis technique for the quality check of DNA.  
PCR.  
SDS -PAGE technique.

### **AB 557 PLANT PATHOLOGY LAB - II**

Study of important plant diseases caused by Bacteria, fungi, nematodes, viruses and mycoplasma on cereals, vegetables, fruit crops, plantation crops & wild plants - Symptoms etiology and morphology.

Isolation of Pathogens and inoculation.

Preparation of media, Isolation of pathogens from different plants and their pure culture on different media.

Inoculation of pathogens in pure culture to healthy plants to reproduce the disease.

Study of effect of temperature pH, pesticides (fungicides) on the growth and reproduction of plant pathogens in culture.

Study of Plant disease enzymes: Viscometric and colorimetric methods.

Study of plant diseases caused by nematodes on brinjal.

Pesticide residue analysis.

Study and production of Disease control material (agents).

#### **AB 558 - BIODIVERSITY AND PLANT CONSERVATION LAB**

Determining minimum quadrat size and number for reliable estimation of biomass in a grassland.

Calculation of mean, variance, standard deviation, standard error, co-efficient of variation and t-test. Correlation and regression.

Study of environmental impact of a developmental activity using checklist as a EIA method.

Calculation of importance of value index (IVI). Shannon - wiener's index, simpson's index, equitability index.

Remote sensing: Aerial photographs and satellite imagery interpretation.

Plant conservation: Study of endemic plants, visit to arboretum and report.

Field work / study tour.