MANGALORE UNIVERSITY
M.Sc., BOTANY (CBCS)

Course pattern and scheme of Examination

I Semester							
Paper Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
				IA	Exam	Total	
Hard Core							
BOH401	Plant Morphology and Taxonomy- I	4	3	30	70	100	4
BOH402	Plant Biochemistry	4	3	30	70	100	4
BOH403	Microbiology	4	3	30	70	100	4
BOP404	Plant Morphology and Taxonomy - Lab- I	4	3	30	70	100	2
BOP405	Plant Biochemistry - Lab	4	3	30	70	100	2
BOP406	Microbiology - Lab	4	3	30	70	100	2
Soft Core							
	One paper to be selected by the student	4	3	30	70	100	3
BOS407	Plant Pathology						
BOS408	Plant Microbe interaction						
BOS409	Anatomy & Histochemistry						
	***to be selected by the student**	4	3	30	70	100	2
BOP410	Plant Pathology - Lab						
BOP411	Plant Microbe interaction - Lab						
BOP412	Anatomy & Histochemistry - Lab						
	Total					800	23

II Semester							
Paper Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
				IA	Exam	Total	
Hard Core							
BOH451	Plant Morphology and Taxonomy- II	4	3	30	70	100	4
BOH452	Plant Physiology	4	3	30	70	100	4
BOP453	Plant Morphology and Taxonomy - Lab- II	4	3	30	70	100	2
BOP454	Plant Physiology - Lab	4	3	30	70	100	2
Soft Core							
	Two papers to be selected by the student	4x2	3 each	30x2	70x2	100x2 =200	3x2=6
BOS455	Molecular plant pathology						
BOS456	Applied Microbiology						
BOS457	Ethnobotany & IPR						
BOS458	Reproductive biology of Angiosperms and Plant Morphogensis						
	***to be selected by the student**	4x2	3x2	30x2	70x2	100x2 =200	2x2=4
BOP459	Molecular plant pathology - Lab						
BOP460	Applied Microbiology - Lab						
BOP461	Ethnobotany & IPR - Lab						
BOP462	Reproductive biology of Angiosperms and Plant Morphogensis - Lab						
Open Elective							
BOE463	Medicinal Plants	4	-	-	-	100	3
	Total					900	25

III Semester							
Paper Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
				IA	Exam	Total	
Hard Core							
BOH501	Plant Ecology & Environment	4	3	30	70	100	4
BOH502	Cytogenetics and Molecular Biology	4	3	30	70	100	4
BOP503	Plant Ecology & Environment - Lab	4	3	30	70	100	2
BOP504	Cytogenetics and Molecular Biology - Lab	4	3	30	70	100	2
Soft Core							
	Two papers to be selected by the student	4x2	3 each	30x2	70x2	100x2 =200	3x2=6
BOS505	Plant Tissue Culture						
BOS506	Seed Technology						
BOS507	Economic Botany						
BOS508	Phytochemical methods						
	***to be selected by the student**	4x2	3x2	30x2	70x2	100x2 =200	2x2=4
BOP509	Plant Tissue Culture Lab						
BOP510	Seed Technology - Lab						
BOP511	Economic Botany - Lab						
BOP512	Phytochemical methods - Lab						
Open Elective							
BOE513	Plant Propagation	4	-	-	-	100	3
	Total					900	25

IV semester

Paper Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
				IA	Exam	Total	
Hard Core							
BOH551	Plant Breeding	4	3	30	70	100	4
BOH552	Plant Biotechnology	4	3	30	70	100	4
BOP553	***Project work	4	-	30	70	100	4
BOP554	Plant Breeding - Lab	4	3	30	70	100	2
BOP555	Plant Biotechnology - Lab	4	3	30	70	100	2
Soft Core							
	One paper to be selected by the student	4	3	30	70	100	3
BOS556	Post Harvest Technology						
BOS557	Biodiversity & conservation						
	Total					600	19

*Practicals of the respective subject chosen by the student.

Soft core papers will be offered depending on the expertise available in the Department.

IA for theory will be based on two tests and one seminar.

IA for practicals will be based on the class records and one practical test.

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M.Sc., BOTANY (CBCS)

Course Code	Title of the Paper	HC/SC/E/P	Hrs	credits
BOH401	Plant Morphology and Taxonomy- I	HC	4	4
BOH402	Plant Biochemistry	HC	4	4
BOH403	Microbiology	HC	4	4
BOP404	Plant Morphology and Taxonomy - Lab- I	HC	4	2
BOP405	Plant Biochemistry - Lab	HC	4	2
BOP406	Microbiology - Lab	HC	4	2
	One paper to be selected by the student	SC	4	3
BOS407	Plant Pathology			
BOS408	Plant Microbe interaction			
BOS409	Anatomy & Histochemistry			
	***to be selected by the student**	SC	4	2
BOP410	Plant Pathology - Lab			
BOP411	Plant Microbe interaction - Lab			
BOP412	Anatomy & Histochemistry - Lab			
BOH451	Plant Morphology and Taxonomy- II	HC	4	4
BOH452	Plant Physiology	HC	4	4
BOP453	Plant Morphology and Taxonomy - Lab- II	HC	4	2
BOP454	Plant Physiology - Lab	HC	4	2
	Two papers to be selected by the student	SC	4x2	3x2=6
BOS455	Molecular plant pathology			
BOS456	Applied Microbiology			
BOS457	Ethnobotany & IPR			
BOS458	Reproductive biology of Angiosperms and Plant Morphogensis			
	***to be selected by the student**	SC	4x2	2x2=4
BOP459	Molecular plant pathology - Lab			
BOP460	Applied Microbiology - Lab			
BOP461	Ethnobotany & IPR - Lab			
BOP462	Reproductive biology of Angiosperms and Plant Morphogensis - Lab			

BOE463	Medicinal Plants	E	4	3
BOH501	Plant Ecology & Environment	HC	4	4
BOH502	Cytogenetics and Molecular Biology	HC	4	4
BOP503	Plant Ecology & Environment - Lab	HC	4	2
BOP504	Cytogenetics and Molecular Biology - Lab	HC	4	2
	Two papers to be selected by the student	SC	4x2	3x2=6
BOS505	Plant Tissue Culture			
BOS506	Seed Technology			
BOS507	Economic Botany			
BOS508	Phytochemical methods			
	***to be selected by the student**	SC	4x2	2x2=4
BOP509	Plant Tissue Culture - Lab			
BOP510	Seed Technology - Lab			
BOP511	Economic Botany - Lab			
BOP512	Phytochemical methods - Lab			
BOE513	Plant Propagation	E	4	3
BOH551	Plant Breeding	HC	4	4
BOH552	Plant Biotechnology	HC	4	4
BOP553	***Project work	P	4	4
BOP554	Plant Breeding - Lab	HC	4	2
BOP555	Plant Biotechnology - Lab	HC	4	2
	One paper to be selected by the student	SC	4	3
BOS556	Post Harvest Technology			
BOS557	Biodiversity & conservation			

*Practicals of the respective subject chosen by the student

Soft core papers will be offered depending on the expertise available in the Department

IA for theory will be based on two tests and one seminar

IA for practicals will be based on the class records and one practical test

MANGALORE UNIVERSITY

DEPARTMENT OF BOTANY

Scheme for M.Sc., CBCS Course

Semester	No. of papers	Hard core				Soft core				Open elective		Total credits
		Theory		Practicals		Theory		Practicals		Theory		
		Hrs	Credits	Hrs	Credits	Hrs	Credits	Hrs	Credits	Hrs	Credits	
I	4	4	4x3=12	4	2x3=6	3	3x1=3	4	2x1=2	-	-	23
II	5	4	4x2=8	4	2x2=4	3	3x2=6	4	2x2=4	3	3	25
III	5	4	4x2=8	4	2x2=4	3	3x2=6	4	2x2=4	3	3	25
IV	4	4	4x2=8 4x1=4*	4	2x2=4		3x1=3		-	-	-	19

* **Project work**

HC credits	- 58	63%
SC credits	- 28	30%
Open elective	- 06	7%

	92	
	====	

SEMESTER I

BOH401 - PLANT MORPHOLOGY AND TAXONOMY – I

Teaching Hours: 10/Unit

Unit I:
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:
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:
Brief history of development of plant taxonomy: Brief history of taxonomic studies in India. Contributions of Van Rheede, 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, Revisionary studies and Monographs: Keys - indented and bracketed keys.

Unit IV:
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). Brief account of APG system.

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

Magnoliaceae, Annonaceae, Menispermaceae, Nymphaeaceae, Capparidaceae, Caryophyllaceae, Clusiaceae, Dipterocarpaceae, Oxalidaceae, Balsaminaceae, Meliaceae, Rhamnaceae, Vitaceae, Leeaceae, Sapindaceae, Leguminosae, Rosaceae, Droseraceae, Rhizophoraceae, Combretaceae, Melastomataceae, Lythraceae, Passifloraceae, Cucurbitaceae, Cactaceae.

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 1st Ed, Campus Book International Publishe,r New Delhi.

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

BOH402 - PLANT BIOCHEMISTRY

Teaching Hours: 10/Unit

Unit I

Membranes : structure, chemical composition, models, transport processes - passive, active, bulk transport.

Plant enzymes - classification, kinetics and mechanism of action.

Unit II

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

Unit III

Proteins and aminoacids: classification, structure - primary, secondary, tertiary and quarternary; 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

Vitamins - classification, distribution, structure, production, function.

Secondary plant products: structure, biosynthesis and distribution of terpenes, phenolics and nitrogen containing compounds.

Unit V

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 9th 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 5th 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 6th 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 2nd 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.

BOH403 - MICROBIOLOGY

Teaching Hours: 10/Unit

Unit I:
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.Microscopy - Its principles and applications, Simple - Compound, Dark field, phase contrast, Fluorescent and Electron Microscopes - SEM, TEM, Principles.

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

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

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

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

Suggested Reading:

Alexopoulus, C.J., Mims, C.W. and Blackwel, 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 & Daginawater. 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.
Dubey RC and Maheswari DK (2005). A text book of Microbiology, Revised Multicolour edition, S Chand Publishers, New Delhi

Purohit S.S.,(2005) Microbiology - fundamentals and Applications. Student Edition Publishers, Jodhpur.

Pelezar & Kreig (2006). Microbiology 5th edition. Tata McGraw Hill, New Delhi

Powar & daginawala (2005), General Microbiology Vol.I & II 8th Edition, Himalaya Publishing House, Mumbai

Salle, AJ (2001). Fundamentals & Principles of Bacteriology, 7th edition. Tata McGraw-Hill, Davis

BOP404 - 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.

BOP405 - 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.

BOP406 - MICROBIOLOGY - LAB

Introduction - good laboratory practices, sterilization methods, instrumentation.

Staining methods - Gram staining, staining of endospores

Determination of bacterial motility

Preparation of Media, Bacterial and Fungal cultures

Micrometry

Study of AM fungi

Mushroom - Spawn production and cultivation

BOS407 - PLANT PATHOLOGY

Teaching Hours: 9/Unit

UNIT I

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

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

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

Plant disease cycles, Epidemiology and Forcasting:
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

Host-parasite interactions: Pathogenic factors in disease development - Mechanism of penetration and establishment - prepenetration, penetration and infection phases; invasiveness - biotrophic and nectrotrophic 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 infectional 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.

BOS408 - Plant Microbe Interaction

Teaching Hours: 9/Unit

Unit I:

Plant-associated microbial pathogens

Classification of microbes associated with plant systems: Bacteria, fungi and oomycetes, phytoplasmas and spiroplasmas, protozoa, parasitic algae, viroids and viruses.
Generalised scheme of their anatomy, physiology and reproduction
Mechanism of infection and symptoms
Plant disease epidemiology
Economic losses

Plant-bacterial interactions
Quorum sensing
Plant penetration (foliar and soil-borne bacteria), attachment
Role of cell-wall degrading enzymes (CWDEs), toxins, hormones and extracellular polysaccharides (EPSs)
Determinants of host specificity, bacterial *Avirulence* genes (*Avr*)
Type III secretion in plant pathogens
Hrp-pili, regulation of *hrp* genes
Secreted proteins, secretion signals
Role of plasmids
Diseases caused by bacterial interaction

Unit II:

Plant-fungal interactions
Dispersal of spores, attachment, penetration methods, appressorial development
Cell-wall degrading enzymes (CWDEs) and mycotoxins
Necrotrophy and biotrophy
Host barriers, overcoming host barriers (quiescence, detoxification of phytoanticipins, detoxification of phytoalexins, suppression of active oxygen species, avoidance of recognition)
Fungal and oomycete genetics [concepts of race structure, *Avirulence* genes (*Avr*)]
Diseases caused by fungal interaction

Plant-viral interactions
Structure of plant viruses
RNA viruses
DNA viruses
Transmission of viruses by vectors (insects, nematodes, fungi, seeds and pollens)
Movement of plant viruses in plants
Viral effects on plants (Alteration in host gene expression, host cell metabolism and suppression of defence responses)
Virus-resistance mechanisms in plants, post-transcriptional gene silencing (PTGs)

Unit III:

Beneficial microbes

Rhizobium-legume symbiosis
Nitrogen-fixing bacteria in non-legumes
Epiphytic microbes
Rhizosphere bacteria
Mycorrhizae
Endophytes

Unit IV:

Plant tumors
Viral tumors, Fungal galls, Bacterial tumors, Nematode galls, Galls caused by Mycoplasma and Rickettsia, Insect galls; causes for tumors - Physical factor, chemical factors and Genetic factors.

Unit V:

Plant defense processes
Preformed defense mechanisms
Inducible defence mechanisms
Recognition of a pathogen [Gene-for-gene resistance, plant *Resistance* (*R*) genes, pathogen *Avr* gene products]
R gene (leucin-rich repeats, cellular localization of recognition, TIR domains, NBS domain, other *R* gene domains, genetic organisation of *R* genes, mechanism of generation of new *R* gene specificities, coevolution of *R* genes)
Pathogen associated molecular patterns (PAMPs), PAMP-triggered immunity (PTI), effector proteins, effector-triggered immunity ETI), microbe-induced molecular patterns (MIMPs)
Elicitation of defence response and activation of signal transduction (oxidative burst, PAMPs trigger protein kinases, ion fluxes, nitric oxide, activation of transcription factors)
Hypersensitive response (HR) and systemic acquired resistance SAR) {programmed cell death (PCD), signalling molecules of SAR [salicylic acid (SA), jasmonic acid (JA), ethylene], *Pathogenesis- related* protein genes (*PR*), master regulator protein NPR1 (Non-expresser of *PR* genes)}
Induced systemic resistance (ISR)

References
Arun Misra 1985 Plant tumors Today and Tomorrow’s Printers and Publishers, New Delhi. pp 222

Agrios, G N. Plant Pathology (2006) Academic Press.

Dickinson M. Molecular Plant Pathology (2003) BIOS Scientific Publishers.

Jeng-Sheng H. Plant pathogenesis and resistance: Biochemistry and Physiology of Plant Microbe Interactions (2009) Kluwer Academic Publishers.

Sullia, S B. and Shantharam, S. General Microbiology (1998) Oxford & IBH Publishing Co.
Pvt. Ltd., New Delhi

Reed, G. (Ed.). Prescott & Dunn's Industrial Microbiology (1983) (4th Ed.), AVI Publishing Co., Connecticut, U.S.A.

Gray Stacey, Beth Mullin and Peter M. Gresshoff. Biology of Plant – Microbe Interactions1996) Proceedings of the 8th International Symposium on Molecular Plant-Microbe Interactions, conducted at Knoxville, Tennessee, during July 14-19, 1996. Pub. International Society for Molecular Plant-Microbe Interactions, St. Paul, Minnesota, USA.

BOS409 - Anatomy & Histochemistry

Teaching Hours: 10/Unit

Unit I:
Primary vegetative body of the plant:Stem: Arrangement of tissues, epidermis, cortical bundles, medullary bundles, steles of various types: Leaf-Structure of foliage leaves, petiole and node of dicot leaves, vascular system of moncot leaves, stem-leaf junction of monocots, structure of fern and gymnosperm leaves: Structure of modified leaves-Kranz anatomy and C4 photosynthesis. Xerophytic and submerged foliage leaves, cataphylls, hypsophylls: Root-Structure of primary root, mucigel, epidermis, exodermis, dimorphic roots, root nodules.

Unit II:
Ultra structure of the cell wall and differentiation. Ultra structure and differentiation of xylem and phloem: tracheary elements and their differentiation, sieve elements and their differentiation. Meristems: Apical meristems, shoot apex of Pteridophytes, gymnosperms and angiosperms, root apex and intercalary meristems. Secondary growth of the plant body: Periderm, variations in wood structure. Anomalous secondary growth in climbers and monocots. Floral anatomy: Flower, flower parts and their arrangement, vascular system, floral meristem, origin and development of floral parts. Pathological Anatomy.

Unit III:
Plant Histochemistry:
Minerals, Carbohydrates, Lignins, Polyphenols, Proteins, Nucleic acids and Histones, Lipids, Cutin, Suberin and Waxes, Ascorbic acid.Study of the instruments, their principles and uses (a) Camera lucida, (b) Micrometry (c) Microtomes –sledge Rocking, Rotary (D) Fluorescence microscope (e) Electron Microscope.

Unit IV:
Staining technique –Principles of histochemical stain

s, Killing, fixing & staining of plant tissues;Important reagents & chemicals needed in the fixatives; FAA, Carnoy's fluid, Navashins solution, fleminge; Dehydrating agents, mounting media, Double staining, Saffranin, Fast green, Embedding: TBA method, embedding for electron microscope, Sectioning, Whole mounts maceration. Histochemical-PAS Test, Sudan black lipids, Feulgen reaction –N acids.

BOP410 - PLANT PATHOLOGY - LAB

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.

BOP411 - Plant Microbe Interaction - Lab

Study of Rhizolium nodules

Ephiphytic microbes

Phyllopaneand Rhisosphre microflora

Endophytes

Plant tumors

Cell wall degrading enzymes

BOP412 - Anatomy & Histochemistry - Lab

Staining of xylem and phloem elements.

Anatomy of roots in: Ficus, Musa, Dieffenbachia, Orchid.

Anamalous secondary growth in the following examples: Stems of Aristolochia,

Nyctanthes, Pyrostegia, Peperomia, Tinospora, Achyranthes.

Ecological anatomy.

Pathological anatomy.

Vasculature in floral organs.

Double staining technique.

Embedding: TBA method, embedding for electron microscope, Sectioning, Microtomes,Whole mounts maceration.

Histochemical-PAS Test, Sudan black lipids, Feulgen reaction –N acids

Reference:

Abraham F. 1982. Plant Anatomy. 3rdedn. Pergaon Press. Oxford.

Cariquist S, 1967. Comparative Plant Anatomy-Holt Reinert and Winston, NY.

Cutter D G, 1971. Plant Anatomy- Part 1, Cell and Tissues Edward Arnold London.

Cutter D G, 1971. Plant Anatomy-Part 1, Cell and Tissues Edward Arnold London. Part-II.

Eames and McDaniel 1947, II edn., " Plant Anatomy" McGraw Hill, N.Y.

Esau K 1965, Plant Anatomy, Joh Wiley and Sons, N.Y.

James D Mauseth, 1998. Plant anatomy The Benzamin/ Cummins Publishing Co.Inc.

Katherine Esau, 1979, Anatomy of seed plants-first Wiley eastern reprint. New Delhi.

Krishnamurthy K. V. 1988. Methods in Plant Histochemistry. S. Viswanathan (Printers and Publishers) Pvt. Ltd. Madras.

SEMESTER II

BOH451 - PLANT MORPHOLOGY AND TAXONOMY - II

Teaching Hours: 10/Unit

Unit I:
Pteridophyta - Distribution and classification of pteridophytes. Evolution of steles; fossil pteridophytes; Heterospory and the origin of seed habit; Economic importance.

Unit II:
Gymnosperms:Distribution and classification of gymnosperms. Brief account of the families of Pteridospermales Lygenopteridaceae, Medullosaceae, Caytoniaceae, Glossopteridaceae; General account of Cyacadeoidales and Cordaitales; Structure and reproduction in Cycadales, Ginkgoales, Coniferales, Epherdrales, Welwitchiales and Gnetales. Economic importance.

Unit III:
Angiosperm taxonomy:Taxonomic evidence:Anatomy, Palynology, Chemotaxonomy, Cytotaxonomy, Numerical taxonomy.

Unit IV:
Study of following families with their phylogeny as per Bentham & Hookers system Rubiaceae, Asteraceae, Sapotaceae, Ebenaceae, Oleaceae, Asclepiadaceae, Loganiaceae, Gentianaceae, Boraginaceae, Scrophulariaceae, Lentibulariaceae, Bignoniaceae, Acanthaceae, Verbenaceae, Amaranthaceae, Podostemaceae, Piperaceae, Myristicaceae, Lauraceae, Loranthaceae, Santalaceae, Moraceae, Urticaceae.

Unit V:
Hydrocharitaceae, Orchidaceae, Musaceae, Zingiberaceae, Liliaceae, Amaryllidaceae, Dioscoreaceae, Commelinaceae, 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 Mac Million 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.

BOH452 - PLANT PHYSIOLOGY

Teaching Hours: 10/Unit

Unit- I

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

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

Unit- II

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

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

Unit III

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

Environmental physiology: Response of plants to environmental radiation; allelochemicals and allelopathy; stress physiology - stressful environments, water stress, chemical stress, temperature stress; stress tolerance Chronobiology: Circadian and other rhythms, clock mechanisms, biological clock.

Unit- V

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 photophosporylation, photolysis, electron transport system; CO2 fixtation; C3 and C4 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.

BOP453 - 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 dichotmous keys for family, genus, and species. Preparation of ten herbarium specimens of common plants.

Field work / study tour.

BOP454 - PLANT PHYSIOLOGY - LAB

Separation of aminoacids 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 C3 and C4 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.

BOS455 - MOLECULAR PLANT PATHOLOGY

Teaching Hours: 9/Unit

UNIT I

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 Systamatic signal transduction, systemic Acquired Resistance.

UNIT II

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

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

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

UNIT V

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 infectional 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.

BOS456 - APPLIED MICROBIOLOGY

Teaching Hours: 9/Unit

Unit I:

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

Unit II:
Bacterial growth - growth curve - Kinetics of Growth - Mathematical expression of exponential growth phase; Measurement of growth and growth yields - Batch Culture - Synchronous growth - Techniques of pure culture. Factors affecting growth and death - physical and chemical.

Unit III:
Microbial toxins: Mycotoxins and bacterial toxins; Food poisoning food infections - exotoxins, enterotoxins, endotoxins, virulence.

Unit IV:
Plant microbe interactions: Symbiosis, Mutualism, commensualism,parasitism, Ecto and endomycorrhiza - Arbuscular Mycorrhiza. Normal microflora of man, pathogenic flora, entry of pathogens and colonization.

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

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 antibodis.

Suggested Reading:

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

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

Black J.C., 2005. Microbiology: Principle and Exploration 6th Ed, John Willey 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 2nd Ed, W.H. Freeman and company, New York.

Murray R.R, Resenthal K.S, Kobayashi G.S and Pfaller M.A., 1994. Medical Microbiology 3rd 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 Copy (2)

BOS457 - Ethnobotany and IPR

Teaching Hours: 9/Unit

Unit I:

Ethnobotany: Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Ethnic groups and Ethnobotany: Major and minor ethnic groups or Tribals of India, and their life styles. Forest Vs. ethnic groups; Plants in Tribal life with reference to Magico-religious rituals and social customs. Sacred groves.

Unit II:

Methodology of Ethnobotanical studies: a) Field work- documenting the information- questionnaire, vedeo recording, interviews b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places f) Protocols.

Unit III:

Role of ethnobotany in modern Medicine with special examples; Medico-ethnobotanical sources in India with special reference to Karnataka; Tribals Vs. Agriculture: Shifting, Podu and Jhum cultivation. Role of ethnic groups on surrounding environment. Crop Genetic sources. Endangered taxa and forest management (participatory forest management).

Unit IV:

Ethnobotany and legal aspects. Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Ethnobotany as a source (recent) of already known drugs: a) Withania as an antioxidant and relaxant b) Sarpagandha in brain ailments c) Becopa and Centella in epilepsy and memory development in children d) Phyllanthus fraternus in diabetic and viral jaundice e) Artemisia as a powerful cerebral antimalarial agent and its possible use in tuberculosis.

Unit V:

Bioprospectin and Biopiracy, Intellectual property Rights: Forms of protection, Patents, Trademarks, Trade secrets, Designs, Geographical indicater, Plant variety protection

BOS458 - Reproductive Biology of Angiosperms and Plant Morphogenesis

Teaching Hours: 10/Unit

Unit I:

Reproductive Biology of Angiosperms: Historical over view, Contributions of P. Maheshwari; BM Johri; BGL Swamy to the development of embryology in India; Microsporogenesis-Male gametophyte development; anther wall layers and functions; Tapetum-types, Concept of male germ unit; Pollen morphological features; Unusual features: pollen development in Cyperaceae, pollen embryosac; Scope of palynology.

Unit II:

Megasporogenesis-Female gametophyte development; Ovular structure & types; Development of monosporic, bisporic, tetrasporic & special types of embryo sacs; Ultrastructure & nutrition of female gametophyte; Fertilization-A general account; double fertilization; single fertilization; heterofertilization & polyspermy; Pollen recognition & rejection reactions-Types; structures; methods to overcome incompatibility reactions; Endosperm-Types; haustorial variati ons; ruminate & composite endosperm; Embryo-Structure; development of monocot, dicot & grass embryo; significance of embryonal suspensor; Experimental Embryology-Scope & applications.

Unit III:

Plant Morphogenesis:Historical developments; Models of morp hogenesis-Comparison of plant v/s animal morphogenetic pathways: Embryo, Coenorhabditis elegans; Concepts-Cell fate/

fate maps, gradients, stem cells in plants and their significance in development, polarity, symmetry, totipotency of cell types, pleuripotency, plasticity, differentiation, redifferentiation, dedifferentiation and regeneration in Acetabularia

Unit IV:
Plant growth and development; types, Shoot apical meristems, root meristems; control of cell division in meristems; Quiescent center & Meresteme de attente; Arabidopsis-vascular patterning and leaf development, abnormal growth; Cellular basis of growth -Maintenance of cell shape; cytoskeletal elements; Photomorphogenesis-Definition, history, Hartmann's technique; Photoreceptors & photo morphogenesis, Localization and properties; effect of bluelight-mediated photomorphogenesis with suitable examples.

BOP459 - MOLECULAR PLANT PATHOLOGY - LAB

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).

BOP460 - APPLIED MICROBIOLOGY - LAB

Study of microorganisms in milk, curd

Isolation of microorganisms - from rhizosphere and non-rhizosphere soil, Microflora of mouth and teeth crevices

Isolation and study of Rhizobium

Viability staining for bacteria, Capsule staining

Concentration of conidia by Haemocytometer Bacterial growth measurement by spectrometric method

Study of milk sample - Methylene blue reductase test

Testing of water sample, fungal growth measurement

Wine preparation

BOP461 - Ethnobotany and IPR - Lab

A visit to a Tribal area to collect data

Listing of Crude drugs in Pansali shops (local crude drugs shops) and their identification (little known drugs only).

A visit to nearby Sacred Groves.

References:

S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.

S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi–1981

Lone et al,.Palaeoethnobotany

S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.

S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.

Colton C.M. 1997. Ethnobotany –Principles and applications. John Wiley and sons –Chichester

Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.

Rajiv K. Sinha –Ethnobotany The Renaissance of Traditional Herbal Medicine –INA–SHREE Publishers, Jaipur-1996

Faulks, P.J. 1958. An introduction to Ethnobotany, Moredale pub. Ltd. London

BOP462 - Reproductive Biology of Angiosperms and Plant Morphogenesis - Lab

Reproductive Biology of Angiosperms:
Microsporangium: Slides: Wall layers; tapetal types; two - celled & three-celled pollen; pollen tetrads

Pollen germination: *Balsam, Delonix, Hibiscus* and *Peltaphorum*

Megasporangium: Slides Female gametophyte development in Penstemon, Xyris pauciflora;2, 4, 8-nucleate stages; mature embryo sac

Endosperm mounting : *Cucumis sativus, Grevellia robusta* & *Croton sparsiflorus*
Embryo: Slides: Monocot, dicot & grass embryo
Embryo mounting : *Crotalaria*

Plant Morphogenesis:
Study of stem cells in plants: SAM, RM

Regeneration abilities of shoot apical meristems of dicots on media with combinations of growth regulators

Study of totipotency in cell types: stomata, epidermal cells, stem and leaf explants on a tissue culture media

Polarity in stem cuttings: *Pothos* spp.

Study of regeneration in succulents *Kalanchoe, Byrophyllum*

Study of leaf galls of plants: *Pongamia pinnata* & *Achyranthes aspera*: Morphological observations and histology.

References:
Johri, B. M. 1984. The embryology of Angiosperms. Springer Verlag

Johri, B. M. 1982. The experimental embryology of vascular plants. Springer Verlag NY

Swamy, B.G.L. & Krishnamurthy, K. V. 1982. From flower to fruit: The embryology of angiosperms. Tata McGraw Hill Co.

Eames 1961. Morphology of Angiosperms. McGraw Hill book Co., Inc., NY

Maheshwari, P. 1950. An introduction to the embryology of Angiosperms. McGraw Hill book Co., Inc., NY

Maheshwari, P. 1963. Recent advances in the embryology of angiosperms. Edited by the International Society of Plant Morphologists, New Delhi

Bhojwani, S. S. & Bhatnagar, S. P. 1978. The embryology of Angiosperms. Vikas Publishing House, New Delhi.

Turing, A. M. 1952. The chemical basis of morphogenesis. Phil. Trans. R. Soc. Lond. B. 237: 37-72.

Sinnot, E. W. 1960. Plant Morphogenesis. Mc Graw-Hill Book Co. Inc. New York, USA.

Steeves, T.A. & Sussex, I. M. 1989. Patterns in Plant development. 2ndedition, Cambridge University Press. Chasan, R. 1994. Tracing tracheary element development. The Plant Cell 6:917-919.

Lyndon, R. F. 1990. Plant Development : The Cellular basis. Unwin Hyman, London.

Aloni, R. 1987. Differentiation of vascular tissues. Annu. Rev. Plant Physiol. 38:179-219.

Raman, A. 2007. Insect induced plant galls of India; unresolved questions. Curr. Sci. 92 (6): 748-757.

Smith, H. 1975. Phytochrome and Photomorphogenesis-an introduction to the photocontrol of plant development. Mc Graw-Hill Book Co. (UK), Ltd.

Mohr, H. 1972. Lectures in photomorphogenesis. Springler-Vohrleg, Berlin, Germany

BOE463 - Medicinal Plants

Teaching Hours: 9/Unit

Unit I:

Plant classification – Broad outline of major groups and ranks of taxa, Plant Nomenclature- Common names, Bionomial 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:

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:

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:

Plants as medicine: Drugs of botanical origin. Medicinal properties of important local plants, Neutraceuticals Bioprospecting, Biopiracy.
Intellectual property Rights: Forms of protection, Patents, Trademarks, Trade secrets, Designs, Geographicalindications, Plant variety protection.

Unit V:

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

Acorus calamus
Andrographis paniculala
Asparagus racemosus
Azadirachta indica
Centella asiatica
Piper longum
Rauwolfia serpentina
Zingiber officinale
Vinca rosea
Emblica officinalis
Cinnamomum suphuratum

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. Priniciples 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.