M.Sc., BOTANY

SYLLABUS
(with effect from July 2018)

Department of Biology
The Gandhigram Rural Institute (Deemed to be University)
Gandhigram - 624 302
Dindigul District
Tamil Nadu
India

M.Sc., BOTANY PROGRAMME
SCHEME OF EXAMINATION

FIRST SEMESTER									
	Course code	**Course Title**	**C**	**L**	**P**	**E**	**CFA**	**ESE**	**Total**
CORE COURSES	18BOTP0101	Plant Diversity	4	4	-	3	40	60	100
	18BOTP0102	Taxonomy of Angiosperms	4	4	-	3	40	60	100
	18BOTP0103	Environmental Biology	4	4	-	3	40	60	100
	18BOTP0104	Molecular Biology#	4	4	-	3	40	60	100
	18BOTP0105	Plant Anatomy, Microtechniques and Embryology	3	3	-	3	40	60	100
	18BOTP0106	Plant Diversity, Taxonomy and Developmental Botany- Practicals	1	-	3	3	60	40	100
	18BOTP0107	Environmental Biology– Practicals	1	-	3	3	60	40	100
CNCC	18GTPP0001	Gandhi in Everyday Life	-	2	-	-	50	--	50
		Total credits	**21**						

SECOND SEMESTER									
	Course code	**Course Title**	**C**	**L**	**P**	**E**	**CFA**	**ESE**	**Total**
CORE COURSES	18BOTP0208	Plant Physiology & Biochemistry @	4	4	-	3	40	60	100
	18BOTP0209	Medical Botany	4	4	-	3	40	60	100
	18BOTP0210	Cell Biology & Genetics	4	4	-	3	40	60	100
	18BOTP0211	Biostatistics	4	4	-	3	40	60	100
	18BOTP0212	Plant Physiology & Biochemistry – Practicals	1	-	3	3	60	40	100
	18BOTP0213	Summer Internship	2	-	-	-	50	-	50
NME	-	Non Major Elective	4	4	-	3	40	60	100
CNCC	18ENGP00C1	Communication and Soft Skills	-	2	-	-	50	--	50
		Total credits	**23**						

THIRD SEMESTER									
	Course code	**Course Title**	**C**	**L**	**P**	**E**	**CFA**	**ESE**	**Total**
CORE COURSES	18BOTP0314	Instrumentation Techniques and Research Methods @	4	4	-	3	40	60	100
	18BOTP0315	Plant Resource Utilization and Biodiversity Conservation	4	4	-	3	40	60	100
	18BOTP0316	Fundamentals of Microbiology @	4	4	-	3	40	60	100
	18BOTP0317	Instrumentation Techniques - Practicals	1	-	3	3	40	60	100
	18BOTP0318	Fundamentals of Microbiology- Practicals	1	-	3	3	60	40	100
	18BOTP0319	Field Visit	-	-	-	-	50	-	100
ME	18BOTP03EX	Major elective	4	4	-	3	40	60	100
MC	18BOTP03MX	Modular course	2	2	-	-	50	-	50
VPP	18EXNP03V1	Village Placement Programme	2	-	-	-	50	-	50
		Total credits	**22**						

FOURTH SEMESTER									
	Course code	**Course Title**	**C**	**L**	**P**	**E**	**CFA**	**ESE**	**Total**
CORE COURSES	18BOTP0420	Biotechnology and Genetic Engineering @	4	4	-	3	40	60	100
	18BOTP0421	Seminar	2	2	-	-	50	-	50
	18BOTP0422	Dissertation	6	12	-	-	75	75*+ 50**	200
	18BOTP0423	Extension/ Field Visit	-	-	-	-	50	-	50
MC	18BOTP04MY	Modular course	2	2	-	-	50	-	50
		Total Credit	**14**						
		Overall Credits 80							

# Courses may offered under MOOC/NPTEL based on availability online and the syllabus also modified per MOOC/NPTEL with equal credits	**@ A portion of the Course may offered under MOOC/NPTEL based on availability online**
*Evaluation by External Examiner	**Evaluation by External and Internal Examiners
L-Lecture Hours	C-Credits
P-Practical Hours	CNCC-Compulsory Non Credit Course
E-Exam Hours	MC- Modular course
CFA-Int-semester continuous assessment	ME – Major Elective
ESE-End Semester Assessment	VPP – Village Placement Programme

***Major Elective Courses (4 credits) 18BOTP03EX**	**Modular Courses (2 Credits) 18BOTP 03MX/ 04MY**
18BOTP03E1 Mushroom Biotechnology	18BOTP03M1 Advanced Molecular Techniques
18BOTP03E2 Plant ecology and Phytogeography	18BOTP03M2 Bioinformatics
18BOTP03E3 Recent Trends in Plant Systematics	18BOTP04M1 Rural Biotechnology
18BOTP03E4 Forest Botany	18BOTP04M2 Plant Tissue culture Technology
	18BOTP04M3 Recent Advances in Botany

18BOTP0101 PLANT DIVERSITY Credits – 4

Objectives:
To enable the students:

- To have comprehensive knowledge on lower plants
- To understand the diversity, reproduction and economic importance of lower plants
- To understand the evolutionary significance of lower plants and Gymnosperms

Learning Outcomes:
The course will provide a comprehensive knowledge on diversity of plant kingdom with focus on Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Paleontology.
On satisfying the requirements of this course, students will have the knowledge and skills on:

- Diversified forms of plants
- Salient features of every classification and can describe the functions of classification
- Review critically the biology and ecology of fossil groups of plants
- Economic importance and special characteristics of the specified examples under each category
- Phylogenetic relationship among lower plants
- Identification of fossil forms of Pteridophytes and Gymnosperms

Unit I
Phycology
Classification of Algae by F.E. Fristch; General characteristics of all classes of Algae; Distribution, habitat, thallus organization, reproduction (vegetative, asexual, sexual) and life cycle of *Chlorella* and *Gelidium*; Phylogeny and Economic importance of Algae.

Unit II
Mycology and Plant Pathology
Classification of Fungi by C.J. Aleoxopolous; General characteristics of all classes of fungi; Distribution, habitat, reproduction (vegetative, asexual, sexual) and lifecycle of *Rhizopus* and *Agaricus;* Economic importance of Fungi. General account on structure and reproduction of Lichens. Outline on plant diseases - causative agents, symptoms and control measures of Tikka disease of groundnut and Blast disease of rice.

Unit III
Bryophytes
Classification of Bryophytes by W. Rothmaler; General characteristics of all classes of Bryophytes; Distribution, habitat, vegetative and anatomic structures, reproduction (vegetative, asexual, sexual) and lifecycle of *Marchantia* and *Funaria;* Phylogeny and Economic importance of Bryophytes.

Unit IV

Pteridophytes

Classification of Pteridophytes by G.M. Smith; General characteristics of all classes of Pteridophytes; Distribution, Morphology, anatomy, reproduction and lifecycle of *Selaginella* and *Adiantum*; Phylogeny and Economic importance of Pteridophytes.

Unit V

Gymnosperms & Paleobotany

Classification of Gymnosperms by K.R. Sporne; General characteristics of all classes of Gymnosperms; Distribution, vegetative, anatomy, reproduction and lifecycle of *Gnetum*; Phylogeny and Economic importance of Gymnosperms. Brief account of process of fossilization, type studies on *Agalophyton* (*Rhynia*) and *Leginoptris*.

Text Books

1. Vashista, P.C., Sinha, A.K. and Kumar, A. 2006. Gymnosperms. Revised Edition. S. Chand & Company Ltd, New Delhi.
2. Vashista, P.C., Sinha, A.K. and Kumar, A. 2005. Pteridophyta. Revised Edition. S. Chand & Company Ltd, New Delhi.
3. Johri, R.M., Latha, S. and Sharma, S. 2004. Textbook of Algae. Dominant Publishers and distributors, New Delhi.
4. Johri, R.M., Latha, S. and Sharma, S. 2004. Textbook of Broyophytes. Dominant Publishers and distributors, New Delhi.
5. Pandey, B. P. 2004. College Botany Volume I & II. S. Chand & company Ltd, New Delhi.

Reference Books

1. Gilbert. M. Smith 1998. Cryptogamic Botany. Volume 1 & 2. Tata McGraw hill Publishing Company Ltd, New Delhi.
2. Aleoxopolous, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. IV edition, John Wiley & Sons, New York.
3. Sporne. K.R. 1976. Morphology of Pteridophytes, 4th edition, B.I. Publication.
4. Parihar. N.S. 1967. An introduction of Embryophyta, vol. III – Pteridophyta, Central book depot, Allahabad.
5. Chapman , V.J. 1962. The Algae. Macmillan & Co. Ltd. New York.
6. Smith, G.M. 1955. Cryptogamic Botany. II. McGraw-Hill Book Co., New York, U.S.A.
7. Fritsch F.E. 1935 & 1945. The structure and reproduction of Algae, Vol. 1&2, Cambridge University press, London.
8. Pathak, C. 2003. Latest Portfolio of Theory and Practice of Pteridophyta. Dominant Publication, New Delhi.

18BOTP0102 TAXONOMY OF ANGIOSPERMS Credits - 4

Objectives:

To enable the students:

- To understand the various aspects of plant nomenclature and classification
- To understand the classical and modern trends of Angiosperm taxonomy
- To understand the salient features of angiosperm families with special reference to sexual characters

Learning Outcomes:

Students are expected to gain theoretical knowledge and acquire basic skills on the plant taxonomy with special reference to Angiosperms. Upon completion of the course, the students will be able to:

- Illustrate the types; merits & demerits of various systems of classification
- Relate taxonomy and other fields of botany
- Combine classical plant taxonomy with modern molecular phylogeny
- Integrate concepts of plant evolution and speciation into and understanding of how organisms are classified in a molecular phylogenetic framework
- Learn the norms of ICBN and Construction of keys
- Identify the angiosperms families with specific key characters
- Learn various advanced tools to study plant taxonomy

Unit I

Introduction to plant taxonomy

History of plant classification; History of botanical explorations and botanical researchers in India; Detailed study on sexual system: Carolus Linnaeus; Natural system: Bentham & Hooker; Phylogenetic system: Bessey and Hutchinson; Angiosperm Phylogenic Group: Brief outline of APG - I (1998), APG - II (2003), APG - III - (2009), AGP-IV (2016).

Unit II

Botanical nomenclature

International code of Botanical Nomenclature; principles of ICBN; Types method; Author citation; Retention and rejection of names; Publication of names; Effective and valid publication; Construction of taxonomic keys: Indented and bracketed keys.

Unit III

Phylogeny and modern aspects

Phylogeny of Angiosperms: Origin and evolution of angiosperms; Taxonomic evidences obtained from Anatomy, Embryology and Palynology, Chemotaxonomy and Molecular taxonomy; Brief account on computer aided plant identification systems; e-floras; Virtual herbaria; Interactive keys.

Unit IV

Morphology and Characters of important families

Salient features; Vegetative and sexual characters of Magnoliaceae, Capparidaceae, Menispermaceae, Rhamnaceae, Meliaceae, Lythraceae, Fabaceae, Sapindaceae, Combretaceae, Vitaceae, Myrtaceae, Aizoaceae, Passifloraceae and Polygalaceae.

Unit V

Morphology and Characters of important families

Salient features; Vegetative and sexual characters of Rutaceae, Acanthaceae, Bignoniaceae, Lamiaceae, Verbenaceae, Loranthaceae, Rubiaceae, Commelinaceae, Orchidaceae, Cyperaceae and Poaceae.

Text Books

1. Sharma, O.P. 2013. Plant Taxonomy. McGraw Hill Education Pvt. Ltd. New Delhi.
2. Mondal, A.K. 2005. Advanced Plant Taxonomy. New Central Book Agency (P) Ltd., New Delhi.
3. Bhattacharyya, B. 2005. Systematic Botany. Narosa Publishing House, New Delhi.
4. Subramanyam, N.S.1999. Modern Plant Taxonomy. Vikas Publishing House, New Delhi.
5. Singh, V., Pandey, P.C. and Jain, D.K.1997. A text book of Botany: Angiosperms. Rastogi Publications, Meerat.

Reference Books

1. Simpson, M.G. 2006. Plant Systematics. Academic Press, London
2. Ramasubbu, R. and Kumuthakalavalli, R. 2014. Trends in Angiosperm taxonomy. The Gandhigram Rural Institute (Deemed to be University), Dindigul.
3. Pandurangan, A.G. Vrinda, K.B. and Mathew Dan. 2013. Frontiers in plant taxonomy. JNTBGRI, Thiruvananthapuram, Kerala.
4. Pullaiah, T. 2007. Taxonomy of Angiosperms. 3rd Edition, Regency Publication, New Delhi.
5. Sivarajan, V. V. 1996. Principles of plant taxonomy. Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
6. Singh, V. and Jain, D. K. 1997. Taxonomy of Angiosperms. Rastogi publications. Shivaji Road, Meerat.

18BOTP0103 ENVIRONMENTAL BIOLOGY Credits - 4

Objectives:

- To provide fundamental principles that provides an in-depth understanding of our environment.
- To provide the scientific basis on understanding on environmental systems which interfere with population and wealth of our natural resources, environmental education, pollution effects and control, monitoring and assessment of environment.

Learning Outcomes:

The Course will provide an overview of scope of environmental biology, fundamental principles, natural and wild life resources & their conservation strategies, remote sensing and applications, pollution, effects and control, monitoring and assessment of environment.

- Understand the scope of environmental biology & Appreciate how ecosystem works
- Appreciate how elements are cycling in the environment
- Identify the natural resources and importance of national parks, sanctuaries and biosphere reserves
- Understand remote sensing and applications
- Appreciate the importance of environmental education
- Describe the types, effects and control of pollution and importance of green house effect ,acid rain and ozone depletion
- Recognise the need of environmental protection acts and laws on air and water pollution
- Realise the organisations involved in environmental protection
- Study the importance of monitoring and assessment of environment

Unit I

Ecosystem, Productivity and Biogeochemical cycles

Scope of Environmental Biology- Structure of Ecosystem- Abiotic and Biotic components (NPTEL) -Types- Terrestrial- Forest and Grassland –Aquatic- Freshwater and Marine- Food chain and food web, ecological pyramids (NPTEL) -Productivity- Primary and secondary- Biogeochemical cycles-Oxygen, carbon, nitrogen, sulphur and phosphorus.

Unit II

Population and Natural Resources

Population ecology-Natural Resources-Renewable- Food, water and forest and Non-Renewable-Land, energy and mineral-Conservation of natural resources-wildlife conservation and management- National parks, sanctuaries and biosphere reserves.

Unit III

Remote Sensing and Environmental Education

Remote sensing-Components, types and applications-GIS and its application-Environmental Education-Objectives, goals, scope, guiding principles and Centre for Environmental Education.

Unit IV

Pollution

Pollution-Types-Air, water, soil and radio-active-sources, effect of Pollution oh human health and control (NPTEL)- Environmental protections acts - Air and water-Environmental Laws- Organizations involved in environmental protection.

Unit V

Assessment and Monitoring

Environmental Impact Assessment-Definition, steps, methods and problems- Public participation – Impact Analysis and Environmental Audit- Environmental Standards-Air and water- Physical, chemical and biological treatment of liquid effluents- Bio indicators and Environmental Monitoring-Bioassay –Application in Environment.

Text Books

1. P.D. Sharma 2017 Ecology and Environment- Rastogi Publication, Meerut.
2. N. Arumugam and V. Kumaresan- 2017 Environmental Biology, Saras Publication, Nagarcoil.
3. Purohit,Shammi & Agrawal 2012 Environmental Sciences – A New Approach Agrobios (India), Jodhpur.
4. Sharma, P.D. 2002 Environmental biology Rastogi and company, New Delhi
5. Metcalf and Eddy 2011 Waste water Engineering- Treatment and Reuse.Tata Mc Graw Hill Education Pvt.Ltd, New Delhi. Pp.311-1026.

References

1. P.D. Sharama 2013, Environmental Biology and Toxicology- Rastogi Publication, Meerut.
2. Pushpa Dahiya and Manisha Ahlawat 2013 Environmental Science- A New Approach,Narosa Pub. House, New Delhi.pp.2.1-2.60.
3. Agarwal, S.K. 2002 Eco – informatics. Vol I, III, IV APH pub. Company, New Delhi. Vol. I: 135 – 165 : 265 – 311; Vol. III : 221 – 259; Vol. IV : 1-140.
4. V.S. Kulkariani, S.N. Kaw and R.K. Trivedy 2002. Environmental Impact Assessment for wetland protection. Scientific publishers (India).
5. Kaiser Jamil 2001 Bio indicators and biomarkers of Environmental pollution and Risk assessment. Oxford and IBH Pub. Co. Pvt. Ltd, New Delhi. pp.1 – 168.
6. Kailash Thakur 1997 Environmental protection law and policy in India. Deep and Deep pub. New Delhi. pp. 184-197; 210 – 248.

Course url

1. http://nptel.ac.in/courses/122103039/40
2. http://b-ok.xyz/book/671429/bc900f
3. http://b-ok.xyz/book/2463090/f0ce34

18MIBP0104 MOLECULAR BIOLOGY Credits -4

(May also be offered under MOOC / NPTEL with Syllabus available online)

Objectives:

- To impart information on the historical developments in Molecular Biology
- An in-depth study on structure and organization of chromosome, replication process, transcription process, translation process and mutagenesis.
- To expose the students on the basic understanding of various techniques used in molecular studies.

Learning outcomes:

- Understand in-depth knowledge on Molecular Biology
- Know various types of Mutagenesis
- Understand in detailed mechanisms of DNA Replication
- Understand the overall concepts of Transcription
- Understand in detailed mechanisms Translation

Unit-I :

Introduction to Molecular Biology

Introduction and historical development - Central dogma of Molecular biology. The Logic of molecular biology – the efficient argument, examination of models and strong inference. Molecules of life – DNA world – RNA world and protein world. Prokaryotic and Eukaryotic Chromosome organization. Genes – definition, types and functional organization. Structure of DNA - primary, secondary and different forms (A, B & Z). Gene transfer mechanism- bacterial transformation, conjugation and transduction.

Unit- II:

Mutagenesis

Mutation – Types – Molecular and biochemical basis of mutation. Mutagenesis – Spontaneous and induced – Base – analog, physical agents, chemical mutagens, intercalating substances and mutator genes. Reversion – definition – Types – Mechanisms – application (Ames test). Mutants – Types and Uses – bacterial mutants, plant mutants and animal mutants.

Unit-III :

DNA Replication

Basic rule. The Geometry of DNA replication – Semiconservative replication of double – stranded DNA and Circular DNA molecules. Enzymology – DNA Polymerases I and III, DNA ligase and DNA gyrase. Events in the replication fork – Continuous and discontinuous. Plasmid and φ174 DNA replication. DNA damages – DNA repair mechanism – photoreactivation, excision repair, recombinant repair and DSOS function

Unit – IV :

Transcription

Basic factors of RNA Synthesis - RNA ploymerases – I, II and III - Transcription Mechanisms in prokaryotes and eukaryotes – chain Initiation, elongation and termination. Significance of pribnow box, TATA box, CAAT box and enhancers in transcription initiation. Rho dependent and Rho independent termination of transcription. Classes of RNA Molecules – Messenger, ribosomal and transfer RNA. Post – transcriptional modification - RNA splicing – role of lysozyme – Spliceosomes, Group I and Group II introns Self-splicing. Capping and tailing of 5' and 3' termini of Eukaryotic mRNA molecules.

Unit – V :

Translation

Genetic code – Definition, deciphering of codons – Universality of the code – Wobble hypothesis and codon degeneracy - codon dictionary. Mechanism of protein synthesis - importance of Initiation(IF), elongation(EF) and releasing factors(RF) - post translational modifications – protein splicing and folding – role of molecular chaperones. Regulation of gene expression in prokaryotes – the operon model. Lactose, galactose and tryptophan operon. Feed back inhibition and Allosteric enzymes.

Text Books

1. Lansing M. Prescott, John P. Harley and Donald A. Klein(2002). Microbiology. Mc Graw Hill companies.
2. B. Lewin 2000, Genes VII Oxford University Press.
3. David Freifelder, 1996, Molecular Biology, 4th Reprint., Narosa Publishing House, New Delhi, India.
4. H.D. Kumar, 1993, Molecular Biology & Biotechnology, Vikas publishing house Pvt. Ltd., New Delhi.
5. S.C. Rastogi, V.N. Sharma, Biology & Biotechnology, Vikas Publishing House Pvt. Ltd., New Delhi.

References

1. R.F. Weaver and P.W. Hedrick 1992, Genetics Wh.C. Brown publishers, Dubuque.
2. E.J. Gardener *et al.,*. 1991 Principles of Genetics (8th Ed.,) John Wiley & Sons, New York.
3. Buchanan, Gruissum and Jones, (2000). Biochemistry and Molecular Biology of Plant; ASPP, USA.
4. David Rawn(2012). Biochemistry. Panima Publishers.
5. Richard Calendar (2005). The Bacteriophages, 2nd Edition, Oxford University Press.
6. J.E. Krebs, E.S. Goldstein, and S.T. Kilpatrick(2012). LEWINS Gene XI. Jones and Barttlett Publishers.
7. Alberts et al., Molecular Biology of the Cell, Garland Publications, (2012).

*(NPTEL) - National Programme on Technology Enhanced Learning.

18BOTP0105 PLANT ANATOMY, MICROTECHNIQUES AND EMBRYOLOGY **Credits -3**

Objectives:

To enable the students:

- To understand the various aspects of plant development and sexual reproduction
- To learn different aspects microtechniques used in Plant sciences
- To understand the various developmental aspects of embryology

Learning Outcomes:

This course outline is designed to develop awareness and interest among students on plant anatomy, Microtechniques and Embryology. By the end of the course, students may be able to:

- Discuss the structural elements of plants meristems, organogenesis and embroyology
- Understand the micro and mega sprogenesis; sexual incompatibility, types of endosperm
- Acquire combined knowledge with special emphasis microtechniques

Unit I

Plant Anatomy I

Cell- structure and components; Organization and types of Tissue. Anatomy of root (Primary and Secondary Structure of Mono and Dicots). Anatomy of Stem (Primary, Secondary structure of Mono and Dicots; and Anomalous Structure of *Boerhaavia*). Anatomy of the leaf and petiole. Nodal Anatomy,Anatomy of Seed. Ecology in relation to Anatomy: brief note on adaptation of hydrophytes, xerophytes and halophytes.

Plant Anatomy II

Plant morphogenesis: Meristems – types; Organization of shoot apical meristem; Theories of organization of meristems; Root - stem transition; Cambium: Origin, Structure and function, Factors affecting cambial activity; Wood: Structure, physical and mechanical properties, reaction wood, compression and tension wood, preservation of wood.

Unit III

Microtechniques

Microscopy; Principles of Microscopy – Types and uses of different Microscope in plant anatomy. Photomicrograph; Types and preparation of Microscope Slides; Tissue dehydration, infiltrating and embedding tissues, Sectioning, Microtomy, Staining and Mounting, Whole mount methods, Squash and smears, Labelling methods, Histochemistry and Cytochemistry.

Unit IV

Embryology I

Microsporogenesis: Anther and Pollen development - Physiological relationship of tapetum and sporogenous tissues, pollen fertility, sterility, pollen storage and pollen germination. Megasporogenesis ; Female gametophyte development, structure of pistil.

Unit V

Embryology II

Pollination ; Pollen - Pistil interaction, Double fertilization ; Endosperm types : Nuclear, cellular, helobial and ruminate endosperms. Development of monocot and dicot embryos Incompatibility ; Methods to overcome incompatibility. Apomixis ; genetics of Apomixis and polyembryony : Types and importance.

Text Books

1. Bhojwani, S.S. and Bhatnagar, S.P. 2008. The Embryology of Angiosperms. V Edition, Vikas publishing house Pvt Ltd., Noida, India.
2. Gupta, P.K. 2002. Cytology, Genetics, Evolution and Plant breeding. Deep and Deep publications, New Delhi.
3. Pandey, S.N. and Chadha, A. 2000. Embryology. Vikas Publishing House, New Delhi.
4. Pandey, B.P. 1995. Embryology of Angiosperms. S. Chand & Company Ltd., New Delhi.
5. Pandey, B.P. Plant Anatomy, 2004. S. Chand & Company Ltd., New Delhi.

Reference Books

1. Kierman, J.A. 1999. Histological and Histochemical methods. Butterworth Publications, London.
2. Fahn, A. 1989. Plant anatomy. Peragamon Press, Oxford, New York.
3. Esau, K. 1987. The Anatomy of seed plants. Wiley Eastern Ltd, New Delhi.
4. Maheswari, P. 1950. An introduction to embryology of Angiosperms. McGraw hill, New York.

18BOTP0106 PLANT DIVERSITY, TAXONOMY AND DEVELOPMENTAL BOTANY – PRACTICALS Credit - 1

Objectives:

To enable the students:

- To develop the skill on the identification of lower and higher plants with their salient features
- To develop the skills on preparation of herbarium and microslides for identification
- To create an overall knowledge on the identification of all group of plants including fossil

Learning Outcomes:

The students will be able to:

- Evaluate and discuss groups of plants in terms of their diversity and describe their evolution, phylogeny.
- Apply the taxonomic principles in preparing keys and herbaria
- Analyse the anatomical and embryological stages of plants and their development
- Provides skill in structural and functional characteristics of various plant parts
- Acquire practical knowledge on identification of various groups of plants

EXPERIMENTS:

1. **Morphology of vegetative and reproductive characteristics of the following**:
   Algae: *Hydrodictyon, Bulbochaete, Pithophora, Stigeoclonium, Fritschiella, Codium, Halimeda, Dictyota, Padina, Fucus* and *Batrochospermum*
   Fungi: *Rhizopus, Peziza, Aspergillus, Agaricus, Polyporus* and *Lycoperdon*
   Bryophytes: *Riccia, Marchantia, Plagiochasma, Dumortiera* and *Polytrichum*
   Pteridophytes: *Psilotum, Lycopodium, Selaginella, Adiantum, Pteridium, Polypodium* and *Azolla*
   Gymnosperms: *Cycas, Pinus* and *Gnetum*
   Fossil forms: *Agalophyton* (*Rhynia), Calamites, Bothrodendron, Calamostachys Lyginopteris, Heterangium, Cordaite,* and *Cardiocarpus*
2. **Salient features, vegetative and sexual characters of** the following families: Magnoliaceae, Capparidaceae, Menispermaceae, Rhamnaceae, Meliaceae, Lythraceae, Fabaceae (Faboideae, Caesalpinoideae and Mimosoideae), Sapindaceae, Combretaceae, Vitaceae, Myrtaceae, Aizoaceae, Passifloraceae, Polygalaceae, Rutaceae, Acanthaceae, Bignoniaceae, Lamiaceae, Verbenaceae, Loranthaceae, Rubiaceae, Commelinaceae, Orchidaceae, Cyperaceae and Poaceae
3. Preparation of dichotomous key for angiosperm families
4. Collection, identification and preparation of 15 herbarium specimens and maintenance of a field note book
5. Study to analyze the floristic wealth of nearby hills
6. Analysis and identification of fresh and herbarium specimens
7. Observation of permanent slides of related topics covered in Anatomy (meristem, cambium and wood) and Embryology (anther, pollen, ovule, embryo and endosperm).
8. **Preparation of microsection of vegetative parts of mono and dicots**

Reference Books

1. Vashishta, K.M. 2008. Singa, A.K. and Singh, V.P. Algae. 9th Edition. S. Chand & Company Ltd, New Delhi. .
2. Vashista, P.C., Sinha, A.K. and Kumar, A. 2006. Gymnosperms. Revised Edition. S. Chand & Company Ltd, New Delhi.
3. Vashista, P.C., Sinha, A.K. and Kumar, A. 2005. Pteridophyta. Revised Edition. S. Chand & Company Ltd, New Delhi.
4. Sharma, P.D. 2005. Fungi and Allied Organisms. Narosa Publishing House, New Delhi.
5. Johri, R.M. 2005.Taxonomy. Vols. I-IV, Sonali Publication, New Delhi.
6. Pathak, C. 2003. Latest Portfolio of Theory and Practice in Bryophyta. Dominant Publishers and Distributors, New Delhi.
7. Sporne. K.R., 1976. Morphology of Pteridophytes. 4th edition, B.I. Publication.
8. Gupta. M.N. 1972. The Gymnosperms (2nd Edition) Shiva Lal Agarwala & Co., Agra.
9. Parihar. N.S. 1967. An introduction of Embryophyta. vol. III Pteriodophyta. Central book depot, Allahabad.
10. Sporne. K. R. 1950. Morphology of Gymnosperms. Hutchinson University Library, USA.
11. Gamble, J.S. 1919-1925. The Flora of Presidency of Madras. Vol. I, II and III. Bishen Singh and Mahendra Pal Singh, Dehra Dun.

18BOTP0107 ENVIRONMENTAL BIOLOGY PRACTICALS Credit – 1

Objectives:

- To estimate electrical conductivity, dissolved solids, dissolved oxygen, carbon dioxide, chloride, hardness, BOD and BOD in different water samples
- To understand study the population of plants.
- To understand how to design bioassay studies on industrial effluents/ pesticides using fish, aquatic insects and larvae.

Learning Outcome:

By the end of this course students will be able to:

- Understand how to estimate Electrical conductivity, Dissolved solids. Dissolved oxygen, Carbon dioxide, Chloride, hardness, BOD and BOD in different water samples
- Understand how to study on population of plants.
- Understand the Bioassay studies on industrial effluents/ pesticides using fish, aquatic insects and larvae.

EXPERIMENTS:

1. Estimation of Electrical conductivity
2. Estimation of Dissolved solids.
3. Estimation of Dissolved oxygen
4. Estimation of Carbon dioxide
5. Estimation of BOD in different water samples.
6. Estimation of COD in different water samples.
7. Estimation of Chloride.
8. Estimation of Total hardness.
9. Quadrant study on population.
10. Bioassay studies on industrial effluents/ pesticides using fish, aquatic insects and larvae.
11. Visit to Centre for Geology, GRI, Gandhigram for remote sensing & GIS.

References

1. P.K.Gupta 2012 Methods in Environmental Analysis Water, Soil and Air. Agrobios (India), Jodhpur.
2. APHA 2012 Standard Methods for the examination of water and waste water (20^{th} Edition). American Public Health Association, Washington. D.C.

18BOTP0208 PLANT PHYSIOLOGY AND BIOCHEMISTRY Credits – 4

Objectives:

To enable the students:

- To understand the physiological mechanism of plants
- To understand the various biochemical pathways of plants
- To create a knowledge on different biochemical pathways, physiology and developmental aspects of plants

Learning outcomes:

This course will provide theoretical knowledge in plant structure and their functions. After completion of this course this students are expected to be able to:

- Describe the physiological phenomena of plants in terms of mechanisms
- Will know the overview of biorhythms
- Discuss different metabolic pathways
- Relate the characteristics and role of enzymes
- Comprehend nitrogen and lipid metabolism
- Understand photoperiodism & mechanism of hormones

Unit I

Plant - water relations

Different Bio-physico-chemical phenomena; Diffusion; Imbibitions; Osmosis; Cell as an osmotic system; Absorption and translocation of water and minerals - Definition, pathway, mechanism, factor, significance; Mineral nutrition – Absorption theories, Macro and Micronutrients - Source, function, deficiency symptoms; Solution and sand culture; Transpiration – Definition, types, mechanism, factor, significance.

Unit II

Carbohydrate metabolism

Photosynthesis - Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO_2 fixation-C_3, C_4 and CAM pathways. Respiration and photorespiration – Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.

Unit III

Nitrogen and fat metabolism

Classification of protein based on source, shape, composition and solubility, essential and non-essential amino acids - Nitrogen metabolism: No_3, No_2 and NH_3 assimilation, biosynthesis of amino acids, nitrogen fixation - Lipids: Classification, and importance, lipid metabolism - β Oxidation and Glyoxalate cycle.

Unit IV

Enzymes

Major classes of enzymes - Oxidoreductases, Transferases, Hydrolases, Lyases, Isomerases and Ligases - Characteristics of enzymatic reaction; Michaelis - Menten equation; Enzyme specificity and enzyme inhibitors.

Unit V

Growth and development & Stress physiology

Plant hormones – Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action. Vernalisation; photoperiodism and biological clocks. Sensory photobiology - Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins

Text Books

1. Pandey, S.N. and Sinha, B.K. 2009. Plant Physiology. IV Edition, Vikas Publishing company, Noida, UP.
2. Taiz, L. and Zeiger, E. 2002. Plant Physiology, III Edition Sinauer Associates.
3. Mukhevji, S. and Ghosh, A. K. 1996. Plant Physiology. Tata McGraw- Hill publishing Company Ltd. New Delhi.
4. Sinha, S. K. 2004. Modern Plant Physiology. Narosa publishing House, New Delhi, Chennai, Mubai.
5. Verma, S. K. 1995. A text book of Plant Physiology and Biochemistry. S. Chand & Company Ltd. Ram Nagar, New Delhi.

Reference Books

1. Noggle, G.R. and Fritz, G.J. 2001, Introductory Plant Physiology, Prentaice - Hall, India.
2. Devlin, R.M., 2000, Plant Physiology, Affiliated East West Press Pvt. Ltd.
3. Epstein, E. 2000, Mineral Nutrition in Plants-Principles and Perspectives. Wiley.
4. John Charles Walker,1997. Plant Physiology. McGraw Hill book Company, New York.
5. Devlin and Witham, 1996. Plant Physiology. CBS Publishers and Distributors, Delhi.
6. Salisberry, F.B. and Ross, C.W. 1993. Plant Physiology, IV Edition Wadsworth publishing company, California.
7. Goodwin, T.W. and Mercer, E.I. 1983. Introduction to Plant Biochemistry. Pergaman Press, U.S.A

18BOTP0209 MEDICAL BOTANY Credits-4

Objectives:

To enable the students:

- To understand the various systems of treatment and herbal products
- To understand the effect of various phyto-constituents to cure various ailments
- To learn the preparative methodologies of various drug formulations to control diseases and symptoms

Learning outcomes:

The course will provide an overview of medicinal plants and special knowledge on the Indian medicine and role of herbals in treating various diseases; their pharmocognosy and phytochemicals; herbal gardening and formularies & ethnobotany. On completion of this course students are expected to understand

- Different systems of Indian medicine, drugs from plant parts and their remedial properties
- Pharmacognosy, drug preparation, adulteration, drug evaluation
- Prospective medicinal plant cultivation methods and formularies
- Traditional health care systems & tribal medicines

Unit I

History and Classification of medicinal plants

History, systems and developments of Indian Medicine- AYUSH: Ayurveda, Unani Siddah, Homeopathy; Classification of medicinal plants based upon the plant parts and phytoconstituents; Root drugs - *Aconitum napellus;* Bark drugs- *Cinchona officinalis;* Stem drugs- *Ephedra gerardiana;* Leaf drugs-*Digitalis purpurea;* Flower drugs-*Syzygium aromaticum;* Fruit drugs- *Papaver somniferum*; Seed drugs- *Strychnos nux-vomica;* Whole plant - *Cannabis sativa*; Unorganized drugs - *Aloe vera.*

Unit II

Medicinal plants and Health care

Poisonous plants: Classification; Description, mode of action, symptoms and treatments, some poisonous plants of Algae, Fungi, Pteridophytes, Gymnosperms and Angiosperms; Remedial plants for Cancer, Common diseases of nervous system, circulatory system, respiratory system, urinary system and reproductive system; Psycho active plants; Allergens: types; drug allergy, phytotherapy for allergic symptoms.

Unit III

Pharmacognosy and Drug evaluation

Pharmacognosy - Collection and processing of medicinal plants; Guidelines for harvesting, processing and marketing of medicinal plants; preparation of crude drugs; drug adulteration; methods of drugs evaluation - morphological and organoleptic, anatomical features.

Unit IV

Herbal garden and Cultivation

Herbal gardens - Introduction and scope, principles and process involved; plant growing methods, propagation techniques; cultivation of medicinal plants: *Ocimum tenuiflorum, Aloe vera* and *Papaver somniferum.*

Unit V

Traditional health care system and Ethnobotany

Local traditional health care system: Herbal home remedies of South India; Herbal formularies-Infusions and decoctions, oil extractions, ointments, lotions, washes, suppositories; Ethnobotany of South India.

Text Books

1. Roseline, A. 2011. Pharmacognosy. MJP publishers, Chennai.
2. Maheshwari, J.K. 2000. Ethnobotany and medicinal plants of Indian subcontinent, Scientific publishers, India.
3. Harborne, J.B. 1998. Phytochemical methods. Springer (India) Ltd., New Delhi.
4. Jain, S.K. 1981. Glimpses of Ethnobotany. Oxford & IBH, New Delhi.
5. Kumar, N.C. 1993. An Introduction to Medical Botany, Emkay Publications, New Delhi.

Reference Book

1. Nadkarani, 1981. Materia medica, Popular Prakasam Publication, New Delhi.

18BOTP0210 CELL BIOLOGY AND GENETICS Credits - 4

Objectives:
To enable the students:

- To understand the structure of cell and its various organelles
- To understand the various aspects of organization of Chromosomes
- To acquire broad knowledge on basic and recent trends of genetics

Learning Outcomes:

This course is designed to develop awareness and interest among students on basic structure and function of cell; genetics of various levels of organisms. By the end of the course, students may be able to:

- Understand the structure and function of cell and its organelles
- Acquire combined knowledge on Cell division and cell cycle
- Analyse the various factors determining the heredity from one generation to another
- Acquire combined knowledge with special emphasis on extra chromosomal inheritance.

Unit I

Structure of Cell and cell membranes

Ultra structure of plant and animal cell; Cell membrane: Structure and function, Structural organization and function of intracellular organelles; Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Unit II

Organization of Chromosomes and Cell Cycle

Organization of genes and chromosomes; operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons. Cell division and cell cycle; Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle. Biology of cancer cells; Oncogenes.

Unit III

Cell signaling

Cell signaling; Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.

Unit IV

Mendelian genetics

Mendelian principles: Dominance, segregation, independent assortment; Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests; Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Eugenics - human betterment; Sex determination and Sex linked inheritance.

Unit V

Extra chromosomal inheritance and alterations of chromosomes

Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. Cytoplasmic inheritance; Predetermination - Virus like inclusions and infective particles, milk factor, kappa particles, plastid inheritance, maternal inheritance. Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications.

Text Books

1. Benjamin A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
2. Eldon J. Gardner. 2004. Principles of Genetics 8th edition, John Wiley and Sons, New York.
3. Sundara Rajan , S. 2003. Introduction to Cell Biology. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Verma, P.S. and Agarwal, V.K. 2004. Cell biology, Genetics, Molecular Biology, Evolution and Ecology. S.Chand & Company Ltd. New Delhi.
5. Nair, P.K.G. and Prabhakar Achari, K. 1999. A Text Book of Cell Biology. Konark Publishers Pvt. Ltd., Delhi

Reference Books

1. Giese, A.C. 1999. Cell Physiology. 5th Edition, W.B. Sounders Company.
2. Chariotte J. Averse. 1995. Molecular Cell Biology. Addision Wesley Publ. Co.
3. Gupta and Jains, 1991. The Cell and Biotechnology, 1st Edition, Agro Botanical Publication, New Delhi.
4. Edmund, W. Sinnott, L.C. Dunn and Dobzhansky, T. 1990. Principles of Genetics, 5thedition, Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. Goodenouth, U. 1984, Genetics 3rd edition CBS College Publishing, Halt, Rineshait and Winstion.

18BOTP0211 BIOSTATISTICS Credits – 4

Objectives:

- Students will be able to make informed decisions based on data and apply statistical tools and techniques in their research works

Learning outcomes:

On the completion of the course students may able to:

- Solve problems quantitatively using appropriate arithmetical, algebraic, or statistical methods
- Create and interpret visual representations of quantitative information, such as graphs or charts
- Understand and critically assess data collection and its representation
- Understand why biologists need a background in statistics

Unit I

Introduction to Statistics

Introduction to Bio-Statistics - Development of Biostatistics and its applications - Sources of biological data - Secondary and Primary sources - Classification and tabulation of data - frequency distribution -Diagrammatic and Graphical representation of statistical data

Unit II

Descriptive Statistics

Sampling and Theoretical Distributions - Sampling – meaning, advantages, concept of parameter and statistics, sample size, sampling error, sampling frame, Types of samples – Probability and non-Probability samples – purposive sampling, Reliability of samples. Introduction of probability and its applications – Theoretical Distributions – Binomial, Poisson and Normal distributions; Properties, uses and applications.

Unit III

Sampling and Theoretical Distributions

Descriptive Statistics - Measures of central tendency - Measures of Dispersion: Measures – Mean, Median, Mode Range, and standard deviation, absolute and relative measures of dispersion.

Unit IV

Correlation and Regression Analysis

Correlation and Regression Analysis - Theory of correlation and regression. Definition, uses, types and correlation, Regression Lines – Properties of regression coefficients.

Unit V

Testing of hypothesis

Biological Measures and Hypothesis Testing: Rates, incidence, prevalence, mortality rate, case fatality; Measurement of risk, odds ratio and Bio-assay and dose responses

Test of attributes, small and large sample tests - Analysis of variance – one-way and two-way classification.

Reference Books

1. Arora P.N. Malhan P.K. 1996. Biostatistics, Delhi : Himalaya Publishing House.
2. Gupta, S.P.1992. Statistical Methods, New Delhi: Sultan Chand, 1992.
3. Gupta C.B.1992. An Introduction to statistical methods Vikas Publishers, New Delhi;
4. Daroga Singh, Chaundjari F.S.1986. Theory and Analysis of Sample survey, New Delhi; Wiley Eastern Ltd. New Delhi.
5. Palanichamy S. and Manoharan M. Statistical methods for biologists, Palni Paramount Pub. Palni

Web resources

1.nu.libguides.com/biostatistics

2.https://newonline courses.sciences.psu.edu/

18BOTP0212 PLANT PHYSIOLOGY & BIOCHEMISTRY – PRACTICALS

Credit - 1

Objectives:

To enable the students:

- To develop the skills on quantitative and qualitative analysis of various biochemical components of plants
- To estimate the various biochemicals and their importance to the physiology of plants
- To understand the various physiological actions of plants

Learning outcomes:

This course will provide practical knowledge on Physiology and Biochemistry of plant structure and functions. After completion of this course, the students are expected to:

- Analyze the biochemical components of any plant samples
- Understand the photosynthetic mechanism and related events of plants
- Understand the role of various growth promoting substances and their action
- Acquire knowledge on physiological response of plants to various factors

EXPERIMENTS:

1. Determination of osmotic potential of cell sap by plasmolytic method
2. Estimation of moisture, dry matter and ash content in higher plants through pot culture studies
3. Estimation of total carbohydrates in plant tissues (sugars / starch)
4. Estimation of protein in plant tissues
5. Estimation of lipids in plant Quantification of photosynthetic pigments (Chlorophyll a, b, and carotenoids)
6. Quantification of non photosynthetic pigments (anthocyanin and flavonoids) in plants
7. Separation of anthocyanins by paper chromatography and thin layer chromatography
8. Absorption spectrum of chlorophyll
9. Measurement of hill reaction in isolated mesophyll cells
10. tissues
11. Determination of seed viability by Triphenyl Tetrazolium Chloride (TTC) test
12. Bioassay of IAA and GA_3
13. Determination of catalase and peroxidase activity by Chance and Maehly (1955).
14. Effect of soil less growth on plants (hydrophonics)

Reference Books

1. Palanivelu, P. 2009. Analytical biochemistry and separation techniques. IV Edition Twentyfirst century publication, Madurai.
2. Sawhney, S.K. and Randhir Singh, R. 2000. Introductory Practical Biochemistry. Narosa Publishers, New Delhi.
3. Harborne, J.B., 1998. Phytochemical Method. Springer (India) Pvt. Ltd., New Delhi, 1998.
4. Bajracharya, D. 2003. Experiments in Plant Physiology, Narosa Publishing House, New Delhi.
5. Sadasivam, S. and Manickam, A. 1992. Biochemical Methods for Agricultural Science. Wiley Eastern Limited, New Delhi.

18BOTP0314 INSTRUMENTATION TECHNIQUES AND RESEARCH METHODS

Credits – 4

Objectives:

- To understand the working principles, construction and applications of the instruments used in the studies related to various disciplines of biological sciences.
- To appreciate the importance, concept of research and learn the art of thesis & paper writing and publication.

Learning Outcome:

The Course will provide an overview to know the general laboratory procedures and maintenance of research equipments, Instrumentation of equipments, concept of research and preparation of research proposal & funding agencies

- Understand general laboratory procedures and maintenance of research equipments, microscopy, pH meter and preparation of different buffers
- Describe the pH measurement in soil and water samples\
- Understand how to isolate cellular constituents
- Realise the need of centrifuges and their uses in research
- Understand how to separate amino acids and sugars using paper & thin layer chromatography
- Realise the principle and applications of gas liquid chromatography, HPLC and
- Learn the principles and applications of electrophoresis
- Realise the importance of UV-Visible.
- Understand how to estimate sugars, amino acids and sugars using spectroscopic techniques
- Describe the principle of flame photometer and bomb calorimeter
- Understand the objectives, types and importance of research
- Understand how to present research papers in seminars and conferences
- Realise the need of publication and know the importance of impact factor & citation index
- Describe the methods of writing scientific paper and components of research paper
- Understand how to prepare manuscript & methods of correcting proof
- Able to know how to prepare research proposals, identification of funding agencies and availability of research fellowships

Unit I: Microscopy, pH and Buffer

General Laboratory procedures and maintenance of research equipments- Microscopy- General principles-Confocal Microscope, SEM and TEM (Source-NPTEL)- pH basic principles and construction of pH meter- pH electrodes- Principles and application of buffers- Mechanism of buffer action and preparation of common buffers- Citrate, acetate, tris and phosphate- Application of buffers- pH measurements of soil and water.

Unit II: Isolation, Fractionation and Separation

Isolation, fractionation and separation of cellular constituents- Isolation of chloroplasts, mitochondria, nucleic acids and enzymes- Homogenization- Manual, mechanical and sonication- Centrifugation techniques- Basic principles, Different types of Centrifuges, Analytical and preparative ultracentrifugation methods (Source-NPTEL)- Chromatography- Paper, thin layer, Ion-exchange, column, affinity - separation of amino acids and sugars- Gas liquid chromatography, HPLC.

Unit III: Electrophoresis, Colorimetry and Calorimeter

Electrophoresis- General Principles Horizontal & Vertical gel electrophoresis, Iso electric focusing, 2D, pulse field and immune electrophoresis (Source- NPTEL), Electrophoresis of proteins and nuclic acids- Spectroscopic techniques- UV-Visible and FT-IR - Flame photometer and Bomb calorimeter- Principle and applications.

Unit IV: Research and Project writing Methods

Research- Definition, objectives, types and importance- Research methods in Biological Sciences- Research process- Literature survey- sources- scientific databases- Research report writing- Parts of Thesis and Dissertation-Title, certificate, declaration, acknowledgements, contents- List of tables, figures, plates &abbreviations, Introduction, Review of literature, Materials and methods- Results-Presentation of data-Tables, figures, maps, graphs, photographs-Discussion-Summary, Bibliography/References and Appendix.

Unit V: Article Publication

Presentation in seminars and conferences- Writing scientific paper- Organization of scientific paper- Importance of title- abstract- key words, Introduction, Materials and Methods, Results, Discussion, Acknowledgements and References-Publication in research journals-Standards of Research journals- Peer- review- impact factor-citation index-Preparation of manuscript- Proof correction- proof correction marks-Method of correcting proof- Writing chapters in books- Preparation of Research proposal and funding agencies – Research fellowships.

Text Books

1. Biju Dharmapalan 2012 Scientific Research Methodology. Narosa Publising House, New Delhi.
2. N. Gurumani 2010 Research Methodology for Biological Sciences. MJP Publishers, Chennai..
3. S. Palanichamy and M. Shunmugavelu 2009. Research methods in biological sciences. Palani paramount publications, Palani

4. Rodney Boyer 2001 Modern Experimental Biochemistry. III Ed. Addison Wesley Longman Pte. Ltd, Indian Branch, Delhi, India.
5. Sahu, P.K. 2013. Research Methodology: A Guide for Researchers in Agricultural Science, Social Science and other related fields. Springer, New Delhi.

References

1. K. Kannan 2003 Hand book of Laboratory culture media, reagents, stains and buffers Panima publishing corporation, New Delhi.
2. Keith Wilson and John Walker 2002 Practical biochemistry – Principles and techniques. Fifth edn. Cambridge Univ. Press.
3. P. Asokan 2002. Analytical biochemistry – Biochemical techniques. First dition – Chinnaa publications, Melvisharam, Vellore

Course url

1. http://nptel.ac.in/syllabus.php?subject Id= 102107028.
2. http://b-ok.xyz/book/674611/288bc3
3. http://www.researchgate.net/publication/317181728- Lecture Notes on Laboratory Instrumentation and Techniques.
4. iiscs.wssu.edu/drupal/node/4673
5. http://www.studocu.com/en/search/research methodology?languages =language_en&type=document

*(NPTEL)- National Programme on Technology Enhanced Learning.

18BOTP0315 PLANT RESOURCE UTILIZATION & BIODIVERSITY CONSERVATION Credits – 4

Objectives:

To enable the students:

- To understand the economic importance of different plants
- To understand the origin and diversity of domesticated plants
- To understand the various threats of biodiversity and the strategies for conservation

Learning outcomes:

The course will provide the various uses of plants; biodiversity status, loss and management strategies. On completion of this course the students will be able to:

- Describe economically important plants with binomial names, family & uses and strategies for green revolution
- Analyse the biogeography, status and loss of biodiversity, initiatives for biodiversity conservation
- Have knowledge on biodiversity management, role of biotechnology, organization involved, ITK, IPR and biopiracy

Unit I

Economic Botany I

Botanical name, family, morphology of useful part and uses of Cereals - Paddy, wheat, maize; Millets - Sorghum, Ragi, rye; Legumes - Blackgram, pigeon pea, green gram; Nuts - Ground nut, cashew nut, almond; Vegetables - Tomato, carrot, cabbage; Fruits - Apple, mango, date palm; Fibers - Cotton, jute.

Unit II

Economic Botany II

Botanical name, family, morphology of useful part and uses of Wood - Teak, rose wood; Essential oil - Sunflower oil, Groundnut oil, Sesame oil; Spices and condiments - Cinnamon, Pepper, Cardamom, Nut-meg, Clove, Turmeric, Chillies; Beverages - Coffee, Cocoa; Tannin - Myrobalan; Latex - Rubber; Dyes - Indigo, Henna; Gum - Gum arabic; Sugars - Sugarcane; Fumigatory and mastigatory – Tobacco, Areca nut.

Unit III

Status and Management of Biodiversity

Biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Conservation Biology: Principles of conservation, major approaches on management, Indian case studies on conservation and management trategies (Project Tiger, Biosphere reserves). Environmental pollution; global environmental change.

Unit IV

Biodiversity Status and Loss

Biogeography of India; Biodiversity of India: Species diversity, Genetic diversity and Ecosystem diversity; Loss of biodiversity; IUCN red list categories; International and Indian initiatives on Biodiversity Conservation.

Unit V

Conservation of Biodiversity

Conservation of Biodiversity: Current practices of biodiversity conservation - *In situ* conservation (Biosphere reserve, Wildlife sanctuaries, National parks); *Ex situ* conservation (Botanic garden, Gene banks, Agroforestry, Pollen bank, Seed bank, Cryopreservation); Role of biotechnology in the conservation of biodiversity; Biodiversity information and communication, Indigenous knowledge systems, Biopiracy, IPR.

Text Books

1. Kochhar, S.L. 2011. Economic Botany in the Tropics. IV edition. Macmillan Publishers India Pvt. Ltd. New Delhi.
2. Bawa K.S., Primack, R.V. and Oommen, M.A. 2011. Conservation biology: A Primer for South Asia, ATREE, Bangalore.
3. Krishnamurthy, K.V. 2003. An advanced text book on Biodiversity, Oxford and IBH Publishing Co. Pvt Ltd. New Delhi.
4. Swaminathan, M.S. and Cocchar S.L. (Eds) 1999. Plants and society. MacMillien Publications Ltd. London.
5. Sambamurthy, A.V.S.S. and Subramanian, N.S. 1999. A text Book of Economic Botany, Wiley Eastern Limited ,New Delhi.

Reference Books

1. Pandey, B.P. 1998. Economic Botany, S. Chand & Co., New Delhi.
2. Frankel, O.H.Brown and Burdon, J.J. 1995. The conservation of plant diversity. Cambridge University Press, Cambridge.

18BOTP0316 FUNDAMENTALS OF MICROBIOLOGY Credits-4

Objectives:

- To enhance the students knowledge on the historical aspects and development of microbiology
- To acquire an overall knowledge on the morphology and functions of the structures with the prokaryotes and eukaryotes.
- To make the students knowledgeable on the various techniques involved.
- To give an overview on microbial ecology-microbial habitats, their interactions and plant-microbe relationship

Learning outcomes:

By the end of this course students will be able to:

- Be impressed on the milestones of Microbiology and its present status
- Identify key components and their functions in both prokaryotes and eukaryotes.
- Be able to understand in depth the techniques used in Microbiology
- Have an insight to the interactions and characteristics of microorganisms.

Unit – I : History and Microscopy (Source NPTEL)

Historical and recent developments -Scope of microbiology- Spontaneous generation, germ theory of disease :discovery of penicillin: discovery of vaccination: proposal of one gene one enzyme hypothesis - Major contribution of scientists– Leeuwenhoeck, Edward Jenner, Alexander - Flemming, Joseph Lister, Robert Koch and Louis Pasteur- Modern Microbiology - Landmark achievements in 20th century – Brief view on bacterial classification according to Bergey's manual of Determinative bacteriology - Microscopy: Simple, Compound, Dark field, Phase contrast, Fluorescence and Electron microscopy.

Unit – II *:* Prokaryotic and Eukaryotic Cell (Source NPTEL)

Ultra structure of Prokaryotic and Eukaryotic cell- The Prokaryotic Cell: Size, shape and arrangement of bacterial cells; structure of cell wall, and structures external (glycocalyx, flagella, pili, etc.,) and internal (plasma membrane, cytoplasm, inclusion bodies, etc.,) to the cell wall. The Eukaryotic Cell: Cilia, flagella, cytoskeleton, cytomembrane systems, mitochondria and chloroplast Comparison of Prokaryotic and Eukaryotic cell.

Unit – III : Microbiological Techniques I

Micobial control – Physical methods - Heat, (Low & High temperatures), Filtration, high pressure, Osmatic pressure, Radiation, and Desiccation. Chemical methods – chemical agents, types and mode of action. Use dilution tests and Disc-Diffusion method – Decimal reduction time (D Value).

Unit – IV: Microbiological Techniques II (Source NPTEL)

Cultural techniques: pure culture techniques, types of media - media preparation - preservation of cultures - aerobic and anaerobic culture techniques - growth of bacteria: batch and synchronous culture - factors influencing growth - growth curve. Methods to

study microbial morphology - wet mount and hanging drop method. Staining techniques - Gram's, acid fast, spore and capsule staining.

Unit – V: Microbial Ecology

Microbial habitat- An overview, the niche, aquatic habitats (marine and fresh water)-soil habitats-subsurface and atmospheric. Microbial Interactions- neutralism, mutualisms, commensalisms, competition, amensalisms, parasitism, predation, antagonism, syntrophism and symbiotic associations. Plant-microbes ineractions – Ectomycorrhizae and Endomycorrhizae- Root and stem nodules, rhizosphere and phyllosphere.

Text Books

1. Madigan, M.T., Martinko,J.M., Stahl,DA and Clark, D.P.2011. Brock Biology of Microorganisms 13th Ed. Benjamin Cummings, N.Y.
2. Tortora, G.J, Funke B.R. and Case,C.L..2010. Microbiology: An introduction 10th Ed, Benjamin Cummings, N.Y.
3. Wiley, J.M., Sherwood, L.M. and Wodverton, C.J. 2009. Prescott's principle of Microbiology, Mc Graw Hill, New York.
4. Dubey, R.C and Maheswari, D.K 2005. A text book of Microbiology, Revised Edt., S.Chand Publishers, New Delhi.
5. Pelczar, Jr., Michael, Chan E. C. S. and Kreig Noel. 2000. Microbiology. 5th Ed. Tata McGraw Hill Book Company.

References

1. Jeffery C. Pommerville (2016). Alcamo's Fundamentals of Microbiology (Third Edition). Jones and Bartlett Learning. LLC, Burlington, MA 01803.
2. Hans G. Schlegel. 2012(Reprint). General Microbiology. VII Ed. Cambridge University Press. UK..
3. Stanier, Y. Roger, John L. Ingrahm, Mark L. Wheelis and Page R. Painter. 2003. General Microbiology. V Ed. MacMillan Press Ltd. New Jersey.
4. Sundararajan,S.2003.Microorganisms.IEd.Anmol Publications Pvt.Ltd. NewDelhi
5. Lansing M. Prescott, John P. Harley and Donald A. Klein. 2002. Microbiology. V Ed. WCB/McGraw Hill Company.
6. Salle, A. J. 2001. Fundamental and Principles of Bacteriology. 7th Ed. Tata McGraw Hill Publishing Co. Ltd.
7. John L. Ingrahm and Catherine Ingrahm. 2000. Introduction to Microbiology. II Ed. Brooks/Cole, Thompson Learning division. USA.
8. Brock,T.D.,Smith, D. W and Madigene, M. T. 1997. Biology of Microorganisms: Milestones in Microbiology. Prentice-Hall International Inc. London.

Web resources:

1. http://www.microbiologyonline.org.uk/links.html
2. http://www.bac.wise.edi/microtextbook/index.php
3. http://www.microbeworld.org.uk
4. http://www.staff.ncl.ac.uk/n.y.morris/lectures/class2007.html

18BOTP0317 INSTRUMENTATION TECHNIQUES - PRACTICALS Credit – 1

Objectives:

- To know the methods preparation of buffers and isolation of Biomolecules.
- To separate amino acids, sugars, phytoconstituens using chromatography and electrophoresis.
- To estimate proteins, sugars, nucleic acids, chlorophyll, sodium, potassium, calcium and magnesium using different equipments.
- To demonstrate the methodology of analysis of biomolecules by different techniques.

Learning outcomes:

By the end of this course students will be able to:

- Know the preparation of buffers and isolation of Biomolecules.
- Separate amino acids, sugars, phytoconstituens using chromatography and electrophoresis.
- Estimate proteins, sugars, nucleic acids, chlorophyll, sodium, potassium, calcium and magnesium using different equipments.

EXPERIMENTS:

1. Preparation of buffers and determination of pH using pH meter
2. Extraction of biomolecules through Soxlet apparatus.
3. Separation of amino acids and sugars using paper chromatography.
4. Separation of amino acids and sugars using thin layer chromatography
5. Separation of pigments by column chromatography
6. Separation of proteins based on molecular weight using PAGE
7. Isolation and separation of plasmids and nucleic acids using agarose gel electrophoresis.
8. Calorific value of Feed/ fuelwood samples.
9. Verification of Beer- Lambert's law using spectrophotometer.
10. Estimation of sodium, potassium, calcium and magnesium using Flame photometer
11. Demonstrative analysis of samples by Spectroscopic methods (UV-Vis, FT-IR, Mass spectroscopy, NMR, AAS).
12. Demonstration of blotting techniques and PCR
13. Demonstration of analysis of Biological samples by SEM/EDAX

Reference Books & Manuals

1. Rodney Boyer, 2001. Modern Experimental Biochemistry. III Ed. Addison Wesley Longman Pte. Ltd, Indian Branch, Delhi, India.
2. J. Jeyaraman 1981. Laboratory Manual in Biochemistry. New Age International publishers, New Delhi.

18BOTP0318 FUNDAMENTALS OF MICROBIOLOGY - PRACTICALS

Credit-1

Objective:

- To enhance the student's knowledge and impress upon them the important aspects of microorganisms
- To provide practical knowledge and skill in the isolation and handling of microorganisms
- To understand the working procedure and principles of microscopes.
- To know pure culture techniques and methods of culturing preservation and maintenance of microorganisms
- To gain skill in isolation of microorganisms from various samples.

Learning outcomes:

By the end of this course students will be able to:

- Identify standard methods for the isolation, identification and culturing of microorganisms.
- Comprehend the ubiquitous nature of microorganisms and identify the different groups of microorganisms from different habitats and their applications
- Carry out experiments to evaluate microbial quality of food products and water

EXPERIMENTS:

1. a) Safety measures and rules of conduct to be followed in a microbiological laboratory.
   b) Cleaning of Glasswares
   c) Handling and Care of Microbiological Instruments.
2. a) Microscopic Examination of Living Organisms – Demonstration of Motility (Hanging drop method).
   b) Sample preparation and characterization of microorganisms using Scanning Electron Microscope (SEM).
   c) Measurement of Microorganisms using Micrometry.
3. Staining Techniques – Gram's staining, Acid-fast staining, Endospore Staining and Capsule staining.
4. Basic Laboratory and Culture techniques
   a) Preparation of Culture Media for Microorganisms. Preparation and sterilization.
   b) Demonstration of Techniques for Pure Culture of Micro-organisms by Serial Dilution Techniques and determination of Bacterial numbers.
   i) Streak Plate method, ii) Pour Plate method, iii) Spread Plate method
   iv) Isolation of Anaerobic Bacteria, v) Isolation and maintainance of pure cultures, vi) Determination of bacterial numbers
5. Isolation of Bacteriophage from Sewage.

6. Milk Analysis – Total Aerobic count and Methylene Blue Reductase Test
7. a) Standard Qualitative Analysis of Water
   i) Presumptive Test for Coliform Group of Bacteria.
   ii) Confirmed Test of Coliform Bacteria.
   iii) Completed Test for Coliform Bacteria.

   b)Water Analysis for Total Bacterial Population by Standard Plate Count Method.
   1. Enumeration of Microorganisms from soil using serial dilution technique.
   2. Enumeration of Microorganisms from Air using Air sampler

References

1. James. G. Cappucino. And Natabe Sherman, 2004. Microbiology – A Laboratory Manual, VI Ed., (I Indian Reprint). Pearson Education (Singapore) Pvt. Ltd., India.
2. Dubey, R.C and Maheswari, D.K. 2002. Practical Microbiology, I Ed., Chand and Company Ltd., India.
3. Aneja. K.R, 2002. Experiments in Microbiology plant pathology tissue culture and mushroom production technology, III Ed. New Age International publishers (P) Ltd, New Delhi.
4. Breed and Buchanan. Bergey's Manual of Systematic Bacteriology. 2nd Edition, (Volumes. 1 – 5) (2001 – 2003).

18BOTP0420 BIOTECHNOLOGY & GENETIC ENGINEERING Credits - 4

Objectives:

- To impart information on the historical aspects development of Biotechnology and Genetic Engineering
- To provide knowledge and in-depth study on plant & animal tissue culture techniques, Biosensors, Bio-energy, Concepts & Scope in Genetic Engineering and Applications of Genetic engineering
- To expose the students on the basic understanding of various techniques used in Biotechnology and Genetic Engineering in plant, animal and microbial system.

Learning outcomes:

- Understand in-depth knowledge on the history and concepts and scope in bio-technology
- Gain knowledge on biotransformation & production of useful compounds and uses of biosensors
- Know the alternate energy sources and generation of energy from biomass energy
- Understand the concepts and methods in Genetic Engineering
- Acquire knowledge on applications of genetic engineering in plant, animal and microbial system.

Unit – I :

Concepts and Scope in bio-technology

Historical development - Plant cell and tissue culture techniques – Culture medium - Culture techniques — Anther and pollen culture. Animal tissue cultures techniques - primary culture, cell strains and cell lines – culture medias - Small scale and large scale culture techniques – Animal bioreactors. Protoplast culture technique and its applications. Germplasm and cryopreservation. Immobilization of microbial cells / enzymes – Adsorption, entrapping, ionic bonding, cross linking, encapsulation and microencapsulation. Application of immobilized microbial cells & enzymes.

Unit-II :

Biotransformation and Biosensors ***(Source NPTEL course)***

Biotransformation and production of useful compounds – Glycerol, butanol, acetons, alkene oxide, Poly hydroxy butyrate and valerate(PHBV), Xanthangum and Microbial Leaching. Biosensors – definition and outline design- types of electrode systems – Oxygen electrode system, Fuel cell type electrode, Potentiostatic, Piezoelectric membrane and Dye-coupled electrode membrane filter systems –Biosensors for nutrients (glucose sensors). Sensor for cell population (Lactate sensor) - Biosensor for products (alcohol sensor, formic acid sensor and methane sensor) - Biosensor for environmental control (BOD sensor, Ammonia sensor, Nitrite sensor and Sulfite Ion sensor).

Unit-III :

Biomass and Bio-energy

Energy sources – nuclear energy, fossil fuel energy and non-fossil and non-nuclear energy. Biomass energy – Composition of biomass-wastes as sources of renewable source of energy – Composition wastes – sources of wastes (Industrial, agricultural, forestry, municipal sources). Biomass conversion – non-biological process, direct combustion (Pyrolysis, Gasification, liquefaction); biological process (enzymatic digestion, anaerotic digestion, aerobic digestion). Bioenergy products – ethanol, biogas and Hydrogen.

Unit – IV :

Genetic Engineering *(Source NPTEL course)*

Definition and outline strategy: Enzymology – Restrict enzymes, DNA ligases, reverse transcriptase, klenow fragment, Alkaline phosphatase, Polynucleotide kinase, terminal transferase, Dnase and Rnase. Cloning vehicles- Plasmids – pBR 322 & pUC; phage vector, cosmid vector, shuttle vector, expression vector and YAC vector. Gene cloning strategy – Isolation of foreign DNA and recombinant DNA construct – Transformation – Screening and selection. Expression of cloned genes in prokaryotic and eukaryotic systems – minicell, maxicell, Fused and unfused gene expressions.

Unit-V :

Applications of Genetic engineering *(Source NPTEL course)*

GMOS – transgenic plants – role of *Agrobacterium* - development of transgenic crops for disease resistance, salt tolerances, drought tolerance, herbicide tolerance and nutritional quality –Brief outline on Bt Cotton & golden rice. Transgenic animals - development of Transgenic animals for disease resistance, improved milk content and expression of antibodies. Brief outline on transgenic mice and Cattle. Genetically modified Microorganisms (GMOs) and its applications for antibiotic production, expressing hGH, interferon and human insulin (Humulin). Brief outline on Superbug bacteria. Rules and regulation in biotechnology – biosafety, bioethics, hazards of environmental engineering and intellectual property rights (IPR) and protection (IIP).

Text Books

1. Dubey R.C., 2014.Advanced Biotechnology 1st Edition. S.Chand&Company Ltd., New Delhi.
2. S.B. Primrose, R.M. Twyman, and R.W. Old (2012).Principles of Gene Manipulations; 6th Edn. Blackwell Science.
3. Chhatoval G.R., 1995. Text book of Biotechnology, 1st Ed, Anmol Publications Pvt. Ltd., New Delhi.
4. Kumar H.D., 1991. A text book on Biotechnology 2nd Ed, East-west Press Private Ltd., New Delhi. Pg.1-250; 411-472; 534-555.
5. Glick, B.R. and Pasternak, J.J 1994. Molecular Biotechnology, ASM Press, Washington DC.

Reference Books

1. Dubey R.C., 2001. A text book of Biotechnology 1st Edition.S.Chand&Company Ltd., New Delhi.
2. Glick, B.R. and Pasternak, J.J 1994. Molecular Biotechnology, ASM Press, Washington DC.
3. Kumar, H.D. 1993. Molecular Biology & Biotechnology, Vikas Publishing House Pvt., Ltd., New Delhi.
4. Kumar, H.D. 1991 Biotechnology, 2nd Ed., East – West Press Private Ltd., New Delhi.
5. Trevan, M.D, Boffey, S., Goulding, K.H. and Stanbury, P. 1990. Biotechnology-The basic Principles. Tata McGraw Hill, New Delhi.
6. Demain, A.L., Solomon, N.A. 1986. "Manual of Industrial Microbiology and Biotechnology", ASM Press, Washington.
7. Robert F. Weaver, 2012Molecular Biology; McGraw Hill
8. Keith Wilson and John Walker 2010 Principles and Techniques of Biochemistry and Molecular Biology; 7th Edn.
9. T. A. Brown 2006 Gene Cloning and DNA analysis- An Introduction;, 5th Edition, Wiley Blackwell Publishing

18BOTP03E1 Elective-1 MUSHROOM BIOTECHNOLOGY Credits -3+1

Objective:

To enable the students:

- To understand the various aspects of mushroom technology
- To understand the effective methodology to cultivate Oyster, Button and Milky mushrooms
- To learn the importance and application of Mushrooms and its products

Learning outcomes:

On completion of this course, the students will be able to:

- Understand the mushroom characteristics and their importance
- Comprehend the lifecycles of various classes of fungi
- Discuss on the principles and methods involved in different stages of mushrooms
- Apply their knowledge in cultivating various tropical and subtropical mushrooms and their role in human welfare.

Unit I

Biology of Mushrooms

Introduction to mushroom biology: characteristics, importance of mushrooms - as food, tonics and medicines. Different parts of a typical mushroom. Key to differentiate edible from poisonous mushrooms: Fungal characteristics, habitat, morphology, nutrition and reproduction of fungi.

Unit II

Mushroom technology

General principles of production of mushrooms and mushroom products: Contributing fields - microbiology, mycology and environmental engineering; phases of mushroom technology - pure culture, spawn, preparation of compost, mushroom development, management and marketing.

Unit III

Application of mushrooms

Mushroom biotechnology: Applications of commercial and Wild mushrooms: food, fodder, soil conditioner and fertilizer, nutriceuticals, pharmaceuticals and medicinal properties.

Unit IV

Mushroom cultivation technology

Prospects of tropical mushroom cultivation technology: Oyster mushroom technology, paddy mushroom technology, milky mushroom and button mushroom technology, post harvest technology. Mushroom farming and prospects.

Unit V

Nutrient Profile and Health Benefit

Nutrient profile; Protein, aminoacids, calorific values, carbohydrates , fats, vitamins & minerals. In therapeutic diets for adolescence, for aged persons & diabetes mellitus. Health benefits: Antiviral value, antibacterial effect, antifungal effect, anti-tumour effect, haematological value, cardiovascular and renal effect.

Field visit/Survey

1. Collection and study on charecterics of wild mushrooms
2. Field visit to mushroom farms
3. Demonstration on various stages of tropical mushroom cultivation
4. Interaction with mushroom farmers

Reference Books

1. Philip G. Miles, Shu-Ting Chang, 1997. Mushroom biology, World Scientific, Singapore.
2. Kaul, T.N. 1999. Introduction to mushroom science, Oxford & IBH Co., Pvt. Ltd., New Delhi.
3. Bahl, N. 1988. Handbook on mushrooms. Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi.

18BOTP03E2 Elective-2 PLANT ECOLOGY AND PHYTOGEOGRAPHY

Credits - 3+1

Objectives:

To enable the students:

- To understand the ecological relationship of plants with environment
- To understand the types, structure and function of ecosystem
- To understand the various components ecological succession and pollution.

Learning Outcomes:

On completion of this course, the students will be able to:

- Understand vegetation and their relationship with the ecosystem
- Acquire knowledge on ecosystem organization, biogeochemical cycle and ecosystem stability
- Comprehend the information on Phytogeography of India

Unit I

Ecosystem and function

History and Scope of Ecology ; Definition, branches. Ecosystem - structure and function. Factors affecting environment; Abiotic- Edaphic, Climatic, Topographic. Biotic – Alleopathy. Energetics: Productivity, Food chains, Food webs and Trophic levels, Ecological pyramids.

Unit II

Types of Ecosystem

Ecosystem – types – aquatic, terrestrial, desert and forest ecosystem. Estuarine and mangrove ecosystem – adaptations. Studying vegetation – types – list and count quadrate methods - density abundance frequency, Ecological niche, ecotone, edge effect.

Unit III

Ecological Succession

Ecological succession – Seral and Climax communities – Hydrosere, Xerosere. Bog succession, sand dune succession. Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations.

Unit IV

Pollution

Pollution: types – Pollutants, air, water, soil, thermal, radiation and noise pollution and their impact in environment and control measures. Green house effect, effects and its consequences. Waste recycling. Environmental Impact Assessment (EIA).

Unit V

Phytogeography

Phytogeography – major biome in world and India. Continental drift hypothesis-Gondwana land factors involved in distribution. Endemism, Age and Area hypothesis. Hot spots, Plant exploration. Invasion and introduction.

Field visit/survey

1. Inventory and analysis of local vegetation
2. Field visit to learn plant ecological methods
3. Discussion on Environmental Impact Assessment (EIA)
4. Mini project & report submission

Text Books

1. Schulze, E.D., Beck, E. And K. Muller-Hohenstein. 2005. Plant Ecology. Springer. New York.
2. Odum E.P. Gray, W. Barrelt 2004. Fundamentals of Ecology. 15th edition. Thomas Asia Pvt. Ltd.
3. Chawla, S. 2011. A text book of Environment & Ecology. Tata Mc Graw-Hill, New Delhi.
4. Chapman, J.L. and Reiss, M.J. 1999. Ecology; Principles and Applications. II Ed. Cambridge University Press. New York.
5. Smith, R.L. 1996. Ecology and Field Ecology, Harper Collins, New York.

Reference Books

1. Begon, M. Harper, J.L. and Townssend, C.R. 1996. Ecology, Backwell Science, Cambridge, USA.
2. Agarwal, K.C. (1987) - Environmental biology- Agro-botanical publications, India.
3. Ludwing, J. and Reynolds, J.F. 1988. Statistical Ecology, John Wiley & Sons.
4. Putman, R.J. and S.D. Wratten. 1984. Principles of Ecology. University of California Press, Berkeley and Los Angels.
5. Anathakrishnan,T.N. (1982)-Bioresource Ecology-Oxford & IBH Publ.Co.,Inc.,Belmont.
6. Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.

18BOTP03E3 Elective -3 RECENT TRENDS IN PLANT SYSTEMATICS

Credits-3+1

Objectives:

To enable the students:

- To understand the Evolution and classification of Angiosperms
- To accentuate the awareness on Botanical Nomenclature
- To understand various evidence to solve the problems in Plant taxonomy
- To understand various aspects of Phylogenetic systematics

Learning outcomes:

On completion of this course, the students will be able to:

- Understand the values and importance of Evolution and classification of Angiosperms
- Comprehend the information on nomenclature and various system of classification.
- Acquire knowledge on various aspects of phylogenetics.

Unit I

Evolution of Angiosperms

Introduction to the Angiosperms: General characteristics of Angiosperms; Evolution; Basal angiosperms and Magnoliids; Basal monocots; Petaloid monocots; Commelinids; Basal Eudicots and Caryophyllids; Rosids; Asterids.

Unit II

Systematics and classification

Plant systematics: Components of systematics, Major objectives of systematics; Relevance to society and science. Taxonomic History: Natural systems to cladistics: Natural systems; Phyletic systems; Phenetics; Cladistics.

Unit III

Botanical Nomenclature

Botanical Nomenclature: Kinds of names; International Code of Nomenclature, Names according to rank; Citation of authors; Priority; Type method; Description and naming a new species; Legitimacy; Synonyms. Classification: The components of classification; Characters and their status; Sources of characters.

Unit IV

Taxonomic evidence

Taxonomic evidence: Morphology, Anatomy and ultrastructure; Embryology; Palynology; Cytology; Phytochemistry. Molecular Systematics: Plant genomes: nuclear, mitochondrial, chloroplast; Molecular markers; Generating molecular data: restriction

site mapping, gene sequencing; Analysis of molecular data: alignment of sequences, methods of phylogeny reconstruction.

Unit V

Phylogenetic systematics

Phylogenetics: Taxon selection; character analysis; Character selection, Homology assesement, Character step matrix, Character × taxon matrix. Cladogram construction; Apomorphy, Parsimony analysis, Polytomy, taxon selection and polymorphic characters Cladogram analysis; Phylogenetic classification, Character evolution, biogeography and ecology.

Text Books

1. Stuessy, T.F. 2009. Plant Taxonomy: The systematic Evaluation of Comparative Data. Columbia University Press, New York.
2. Simpson, M.G. 2006. Plant Systematics. Elsevier, Amsterdam
3. Semple, C. and M.A. Steel 2003. Phylogenetics. Oxford University Press, Oxford.
4. Judd, W.S., C.S. Campbell, E.A. Kellogg, P.F.Stevens and M.J. Donoghue 2002. Plant Systematics: A phylogenetic Approach. Sinauer Associates, Inc., Massachusetts.
5. Nei, M. and S. Kumar 2000. Molecular Evolution and Phylogenetics. Oxford University Press, New York.

References

1. Crawford, D.J. 2003. Plant Molecular Systematics. Cambridge University Press, Cambridge, UK.
2. Angiosperm Phylogeny Group 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Botanical Journal of the Linnaean Society 141: 399-436.
3. Crawford, D.J. 2003. Plant Molecular Systematics. Cambridge University Press, Cambridge, UK.
4. Nei, M. and S. Kumar 2000. Molecular Evolution and Phylogenetics. Oxford University Press, New York.

18BOTP03E4 Elective - 4 FOREST BOTANY Credits-3+1

Objectives:

To enable the students:

- To understand the importance and value of forest and its products
- To accentuate the awareness on conservation and sustainable utilization of forest and its resources
- To understand the ecological relationship, hydrological cycle and vegetation dynamics of forest

Learning outcomes:

On completion of this course, the students will be able to:

- Understand the values and importance of various types of forest
- Comprehend the information on conservation and sustainable utilization of forests
- Acquire knowledge on hydrological cycle protected areas and forest research organizations

Unit I

Forest types and associations

General introduction to forest; Classification of Indian forests: Tropical, temperate, evergreen, semi-evergreen, deciduous, monoculture, social, industrial; Forest and climate; Forest and biodiversity; Forest conservation; Forest and ecosystem; Forest and civilization; Multipurpose forestry and preservation of natural forestry and pollution control.

Unit II

Forest ecosystem and NWFP

Strong interrelationships between forest and ecosystem: Forest genetics, forest physiology, forest ecology; Macro dynamic ecosystem reserves, hydrological cycles; Importance and value of wood and Non-wood forest products (NWFP); Major and minor forest products; Use and misuse of forests by man, direct and indirect forest wealth; Forest policies, forest protection through people committee.

Unit III

Siliviculture and forest research

Silviculture: concept and scope; Seed dynamics in forest: seed production, dissemination, germination, establishment and mortality, seedling dynamics; Forest research organizations, importance of forest research.

Unit IV

Conservation of wildlife

Forest and Wildlife: Floristic and faunastic wealth of India; Important Biosphere reserves; National parks and wildlife sanctuaries of India; National policies on Wildlife protection; Keystone species, Importance of wildlife, Forestry for social and national development.

Unit V

Indian Forestry

Scenario on Indian Forestry; Indian Forest Service- UPSC examination, brief outline and discussion on syllabus; hierarchy in forest service. Role of civilian in conserving forest Biodiversity; Recovering Indian Forest Biodiversity. Forest Research Institutes of India. Contribution of FRI, WII, IFGTB and KFRI.

Field visit/survey

1. Field visit to study the types of forest
2. Analyse the value of NWFP/NTFP
3. Visit to forest/silviculture nursery
4. Scientific visit and documentation of wildlife

Text Books

1. Principles of Silviculture, Frederick S. Backer, Mc Graw Hill Book Co. NY, 1950.
2. Forest menturation, Donald Bruce and Grancis X. Schumacher, Mc Graw Hill Book Co. NY, 1950.
3. Multipurpose tree germplasm, Ed. Burley S. and Von Carlowitz P. international council for research in agroforestry, Nairobi, 1984.
4. Tropical forests, Ed. Holm – Neilsen L.B. Nielsen. DC and balslev II Academic press, London, 1989.

MODULAR COURSES

18BOTP 03MX / 04MY ADVANCED MOLECULAR TECHNIQUES Credits-2

Objectives:

- To impart knowledge on advanced biological and molecular techniques
- To provide hands on experience on various advanced Instruments used for biological and molecular studies

Learning outcomes:

The students are being able to:

- Understand in-depth knowledge on Electrophoretic techniques
- Realize Molecular Sequencing techniques
- Know the principle and applications of PCR techniques
- Familiar with Chromatographic and Spectrophometric techniques
- Distinguish Genome sequencing and Physical mapping of genome analysis

Unit I
Electrophoresis
Principle and application: paper electrophoresis, agarose gel electrophoresis, polyacrylamide gel electrophoresis (Native PAGE and SDS- PAGE) and Immunoelctrophoresis.

Unit II
Molecular Sequencing
Amino acid sequencing and analysis -MALDI-TOF, DNA sequencing –Enzymatic & chemical methods and new generation sequencing. Blotting techniques – Southern, northern, western and Dot blots. Microarray techniques – oligonucleiotide array and cDNA array and its applications.

Unit III
PCR techniques
Principle and applications- types of PCR - enzymology- primer types-methods. PCR amplification for Detection of mutation, monitoring cancer therapy, detect bacterial & viral infections, sex determination of prenatal cells, linkage analysis in sperm cells and studies on molecular evolution.

Unit IV
Chromatographic and Spectrophometric techniques
Principle and applications of Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC). Principle and applications of Atomic Absorbance Spectra (AAS), Infra –red (IR) Spectra and LC-MS technique.

Unit V

Genome sequencing and Physical mapping of genome analysis

Restriction fragment Length Polymorphism (RFLP) technique, Random Amplified polymorphic DNA (RAPD) technique and 16 S rRNA sequencing. Methods and applications of Chromosome walking &Chromosome jumping.

Text Books:

1. Glick, B.R. and Pasternak, J.J 1994. Molecular Biotechnology, ASM Press, Washington DC.
2. James .D.Watson, Michael Gilman, Jan Wit Koeski and Mark Zuller, 2001. Recombinant DNA. IInd Ed. Scientific American Book, New York.
3. B. Lewin 2000. Genes VII Oxford University Press.
4. E.J. Gardener *et al.,*. 1991. Principles of Genetics (8^{th} Ed.,) John Wiley & Sons, New York.

18BOTP 03MX / 04MY RURAL BIOTECHNOLOGY Credits -2

Objectives:

- To impart knowledge on various biotechnological commercial processes and its usefulness
- To provide hands on exposure to various biotechnological commercial processes such as biogas production, composting methods, mushroom production, *Spirulina* cultivation and ornamental fish cultures.

Learning outcomes:
The students are being able to:

- Understand in-depth understanding on biogas technology and its uses
- Understand composting technology and its applications
- Know the cultivation and uses of Mushrooms
- Know the cultivation and uses *Spirulina*
- Understand the value of Ornamental Fish culture

Unit I
Biogas technology
Introduction and history – anaerobic digestion – microbes involved – factors influencing methane production – Stages of methane generation – Wastes used in methanogenesis – various bioreactors used for methane generation – Advantages and disadvantages. Visit to biogas production units with field demonstration.

Unit II
Composting technology
Historical background – waste availability – factors influencing – methods- biomaturity-enrichment of Compost and crop productivity. Vermiculture Technologies: History – species – life cycles – methods – different types of waste suitable for vermicomposting. Utilization of vermicompost for crop production. Visit to vermicompost industries with field demonstration.

Unit III
Mushroom technology
Bioconversion of organic wastes into protein - Oyster mushroom technology, paddy mushroom technology, milky mushroom and button mushroom technology, post harvest technology. Mushroom farming and prospects. Visit to mushroom farms with field demonstration.

Unit IV

***Spirulina* cultivation technology**

Biology of *Spirulina* - cultivation methods, post harvest technology and single cell protein formulation. Visit to *Spirulina* industries with field demonstration.

Unit V

Ornamental Fish culture

Present status and importance – popular varieties – artificial and live feeds – breeding techniques of egg layers – gold fish, angel fish, fighter and barbs – live bearers – guppy, molly, platy and sword tail – economics. Visit to ornamental fish farms with field demonstration.

Text Books:

1. Tripati, G. 2003. Vermiresources technology, 1st Ed., Discovery Publication House, New Delhi.
2. Anita Saxena, 2003. Aquarium management. Daya Pub. House, New Delhi.
3. Kaul, T.N. 1999. Introduction to mushroom science, Oxford & IBH Co., Pvt. Ltd., New Delhi.
4. Kumar, H.D., 1991. A Textbook on Biotechnology, II Edition, East-west Press Pvt. Ltd., New Delhi.
5. Chawla O.P. 1986. Advances in Biogas Technology, ICAR, New Delhi.

References

1. Srivastava, C.B.L, 2002. Aquarium fish keeping. Kitab Mahal, Allhabad.
2. Gaur, A.C., 1999. Microbial technology for Composting of Agricultural Residues by Improved Methods, 1st print, ICAR, New Delhi.
3. Subba Rao, N.S., 1999. Soil Microbiology, 4th Ed., Oxford IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Philip G. Miles, Shu-Ting Chang, 1997. Mushroom biology, World Scientific, Singapore.
5. Chatwal, G.R., 1995. Textbook of Biotechnology, Anmol Publications Pvt. Ltd., New Delhi
6. Bahl, N. 1988. Handbook on mushrooms. Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi.

18BOTP 03MX / 04MY BIOINFORMATICS Credits - 2

Objectives:

- An- in depth study on Bioinformatics, microbial genomics and proteomics
- To make the students to understand genome analysis, sequence analysis and protein analysis
- To make the students to know the tools used in Bioinformatics

Learning outcomes:

- Students understand whole genome analysis methods
- Students know the computational tools used for sequence analysis tools
- Students know the use of internet in data analysis
- Students acquire knowledge on DNA microarray techniques
- Students know the different methods of protein analysis

Unit –I : Whole genome analysis: Preparation of ordered cosmid libraries, bacterial artificial chromosome libraries, shotgun libraries and sequencing.

Unit–II : Sequence analysis: Computational methods, homology algorithms (BLAST) for proteins and nucleic acids. PROSITE, PEAM, and Profile Scan.

Unit–III : Databases Analysis: Use of internet, public domain databases for nucleic acid and protein sequences (EMBL, GenBank); database for protein structures (PDB).

Unit-IV : DNA microarray and general Analysis: DNA microarray printing or oligonucleotides and PCR products on glass slides, nitrocellulose paper. Whole genome analysis for global patterns of gene expressions using fluorescent labeled DNA or end labeled RNA probes. Analysis of single nucleotide polymorphisms using DNA chips.

Unit-V : Protein analysis and Proteomics : Sequence analysis of individual protein spots by mass spectroscopy. Protein microarray. Advantages and disadvantages of DNA and protein microarrays. Introduction to docking.

Text Books

1. Read, TD., Nelson, KE., Fraser, CH. 2004. Microbial Genomics. Humana Press Inc., USA.
2. Rashidi, H.H. and Buchler, L.K. 2002 Bioinformatics Basics :Applications in Biological Science and Medicines, CRC Press, London
3. Stephen P. Hont and Rick Liveey (OUP) 2000. Functional Genomics, A practical Approach.
3. Perysju, Jr. abd Peruski 1997. The Internet and the New Biology: Tools for Genomic and molecular Research.
4. Mark Schena (OUP). DNA Microarrays, A practical approach.

18BOTP 03MX / 04MY PLANT TISSUE CULTURE TECHNOLOGY Credits -2

Objectives:

To enable the students:

- To understand the basic principles and methodologies of plant tissue culture
- To understand the different standard protocol for the production of viable clones
- To learn the knowledge on various methods of Tissue Culture and secondary metabolites production.

Learning Outcomes:

This course will impart a thorough knowledge on research oriented learning which will develop analytical problem solving approach. On completion of this course, the students will be able to:

- Understand various media, sterilization, totipotency, cell induction, organogenesis
- Able to apply the techniques to develop a standard protocol for Plant Tissue Culture
- Have comprehensive knowledge on GM technology, bio-safety relations and germplasm storage

Unit I

Basic concepts Plant tissue culture

Plant tissue culture; History, concept of totipotency, sterilization, media types, preparation; culture of plant materials.

Unit II

Plant tissue culture techniques

Basic techniques in plant tissue culture; Methods of plant cell, tissue and organ culture; Cell suspension culture, somatic embryogenesis, protoplast culture;

Unit III

Micropropagation and haploid production

Micropropagation: Methods and application, androgenesis and gynogenesis for haploid production, protoplast culture and somatic hybridization, somaclonal variation and conservation of germplasm.

Unit IV

Secondary metabolites production and GM technology

Production of secondary metabolites from the culture cells; Production of synthetic seeds; edible vaccines; GM technology and bio-safety regulations.

Unit V

Application of plant tissue culture

Application of plant tissue culture in agriculture: Production of Banana, Horticulture: Propagation of Orchids; Forestry: Propagation of a commercial and endangered tree species.

Text Books

1. Kesavachandran, R. and Peter, K.V. 2008. Plant Biotechnology: Methods in Tissue cultute and gene transfer. University Press Ltd. Hyderabad.
2. Bhojwani , S.S. and Razdan , M.K. 1996. Plant Tissue Culture : Theory and Practice (revised edition). Elsevier Science Publishers, New York, USA
3. Jain, S.M.Sopory, S.K. and Veilleux, R.E.1996. In Vitro Haploid Production in HigherPlants, Vols. 1-5, Fundamental Aspects and Methods. Kluwer Academic Publishers,Dordrecht, The Netherlands
4. Bhaojwani, S.S. 1990 , Plant Tissue Culture: Applications and Limitations Elsevier Science Publishers , New York , USA
5. Kartha, K.K. 1985. Cryopreservation of Plant Cells and Organs. CRC Press, Boca Raton, Florida, USA.

Reference Book

1. Vasil, I.K. and Thorpe, T.A.1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers, The Netherlands.

18BOTP 03MX / 04MY RECENT ADVANCES IN BOTANY Credits -2

Objectives:

To enable the students:

- Understand the basic principles of Plant genomics and Proteomics
- Understand the different standard protocol of bioinformatics and Phytochemistry
- Learn the knowledge on various methods of Pharmacognacy and Nanotechnology.

Learning Outcomes:

This course will impart a thorough knowledge on research oriented learning which will develop analytical problem solving approach. On completion of this course, the students will be able to:

- Understand various aspects of Plant genomics and Proteomics
- Able to apply the techniques of bioinformatics and Phytochemistry
- Have comprehensive knowledge on Pharmacognasy and Nanotechnology

Unit I

Plant Genomics and Proteomics

Plant Genomics and Proteomics – Introduction – Plant Genome - Structural genomics - genome sequencing strategies - Functional genomics – genome annotation, gene expression study using microarrays functional annotation of genes – Introduction to proteomics – Applications to plant biology – General view of proteomics – Analytical tools in proteomics – subcellular proteomics – plant with biotic and abiotic factors interaction with proteomics.

Unit II

Bioinformatics and Computational Biology

Bioinformatics and Computational Biology – Introduction, aim and importance of bioinformatics – Database and Mining – Genomics, Transcriptomics and Metabolomics - primary and secondary databases DNA sequence databases - Gen bank: a practical approach – Phylogenetic analysis (PHYLP, TREE) DNA databank, Nucleotide sequence databank (EMBI Bank) -Sequence alignment.

Unit III

Phytochemistry

Phytochemistry– Introduction to Phytochemicals; Alkaloids, Phenolic compounds: Anthocyanins, carotenoids;, flavonoids, tannins Hydroxycinnamic acids – Xanthophylls plants with phytochemicals, Organic acids, lipids and their related compounds: plan acids, Fattyacids and Lipids.Sugars and their derivatives. Extraction of phytochemicals – Developing new drugs from Ethnomedicines.

Unit IV

Pharmacognosy

Pharmacognosy – Introduction – history – Indian System of medicine – natural sources of Drugs – Crude drugs – Classification of crude drugs – Collection and Processing of crude drugs – Phytoconstituents of therapeutic value – Histochemical tests for phytochemicals – Drugs containing carbohydrates/glycosides/lipids/Volatile oils/Resin/Alkaloids/Tanninis – Analytical pharmacognosy – Anatomical features of selected medicinal plants (*Piper, Datura* and *Strychnos*).

Unit V

Nanobiotechnology

Nanobiotechnology – Overview –Biomaterial Science – Fabrication and Characterization of nanostructures –Nanotechnology in Biomedical applications – Health and Environmental impacts of nanotechnology. Biological nanoparticles production - plants and microbes.

Text Books

1. Middha, S.K., Usha, T. And H.P. Prashanth Kumar. 2012. Bioinformatics. College Book House, Bangalore.
2. Sahu, P.K. 2013. Research Methodology: A Guide for Researchers in Agricultural Science, Social Science and other related fields. Springer, New Delhi.
3. Shah.B. and Seth.A. 2010. Text book of Pharmacognosy and Phytochemistry. Elsevier India Pvt. Ltd. New Delhi.
4. Thiagarajan, B. and Rajalakshmi, P.A. 2009. Computational biology. MJP Publishers, Chennai.
5. Agarwal, G.K. and Rakwal, R. 2008. Plant Proteomics Technologies; Strategies and Applications. John Wiley & Sons, Inc, USA.

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1. Roseline, A. 2011. Pharmacognosy. MJP Publishers, Chennai.
2. Bernard Rosner. 2010. Fundamentals of Biostatistics. Brooks/cole, Boston, USA.
3. Balaji, S. 2010. Nanobiotechnology. MJP Publishers, Chennai.
4. RanjithaKumari, B.D. 2008. Plant Proteomics. APH Publishers, New Delhi.
5. Sanaj.J. and Thelen, J.J. 2007. Plant proteomics. Springer, New York.
6. Mahajan. B.K. 1997. Methods in Biostatistics. Jay Pee Brothers Medical Publishers (P) Ltd. New Delhi.