

**GURU NANAK COLLEGE (AUTONOMOUS)
CHENNAI – 42.**

**B. SC. DEGREE COURSE IN
PLANT BIOLOGY & PLANT BIOTECHNOLOGY**



(2016 – 2019 & ONWARDS)

COURSE STRUCTURE & SYLLABUS

APPENDIX – 11 (R & S)
UNIVERSITY OF MADRAS
GURU NANAK COLLEGE (AUTONOMOUS)
B.Sc Plant Biology and Plant Biotechnology (Batch 2016-2019)

Sem.	Part	Course Component	Subject Name	Subject Code	Cdt	Hrs
I	I	Language	Tamil I		3	6
	II	English	English I		3	4
	III	Core I	Algae, Fungi and Lichens		4	6
		Core II	Practical I – Algae Fungi and Lichens		-	2
		Allied I	Allied Zoology I		3	6
	IV		Allied Zoology Practical		-	2
		NME/ Basic Tamil	Nursery and Landscaping		2	2
II	I	Language	Tamil II		3	6
	II	English	English II		3	4
	III	Core III	General Microbiology		4	6
		Core II	Practical I – Algae Fungi and Lichens		4	2
		Allied II	Allied Zoology II		3	6
	IV		Allied Zoology Practical		4	2
		NME/ Basic Tamil	Mushroom cultivation		2	2
III	I	Language	Tamil III		3	6
	II	English	English III		3	4
	III	Core IV	Bryophytes and Pteridophytes		4	6
		Core V	Practical II- Bryophytes and Pteridophytes		-	2
		Allied III	Allied Chemistry I		3	6
	IV		Allied Chemistry Practical		-	2
		Soft Skill based	Personality Enrichment		3	2
IV	I	Language	Tamil IV		3	6
	II	English	English IV		3	4
	III	Core VI	Gymnosperms, Paleobotany & Evolution		4	6
		Core VII	Practical II- (Bryophytes, Pteridophytes & Gymnosperms, Paleobotany, Evolution)		4	2
		Allied IV	Allied Chemistry II		3	6
	IV		Allied Chemistry Practical		4	2
		Soft Skill	Computing skills		3	2
V	III	EVS	Environmental science		2	2
		Core VIII	Cell Biology & Anatomy		4	4
		Core IX	Morphology, Taxonomy of Angiosperm & Embryology		4	4
		Core X	Plant Biotechnology		4	4
		Core XI	Plant Microtechnique		4	4
		Core XII	Practical-III – (Cell Biology, Anatomy, Morphology, Taxonomy of Angiosperm, Embryology, Plant Biotechnology&Plant Physiology & Biochemistry)		-	8
	IV	Elective – I	Plant Diseases & Management		5	5
VI	III	Value Education	Value education		2	1
		Core XIII	Genetics & Plant Breeding		4	4
		Core XIV	Plant Ecology & Phytogeography		4	4
		Core XV	Plant Physiology & Biochemistry		4	4
	III	Core XII	Practical-III – (Cell Biology, Anatomy, Morphology, Taxonomy of Angiosperm, Embryology, Plant Biotechnology&Plant Physiology & Biochemistry)		4	-

		Core XVI	Practical-IV (Genetics, Plant Breeding, Plant Ecology, Phytogeography & Plant Microtechnique)		4	8
		Elective II	Herbal and Ethnobotany		5	5
		Elective III	Horticulture		5	5
	V	Extension Activities			1	-
					140	

GURU NANAK COLLEGE (AUTONOMOUS) -CHENNAI – 42.

PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Course Structure

I Year

Semester - I

SEMESTER	PART	Course component	SUBJECT NAME	CREDIT	HRS.
I	I	Language	Tamil - I / Hindi - I	3	6
	II	English	English – I	3	4
	III	Core - I	Algae, Fungi & Lichens	4	6
		Core - II	Practical – I (Algae, Fungi & Lichens)	2	2
		Allied - I	Zoology – I	3	6
			Allied Zoology Practical	-	2
	IV	1. NME	Basic Tamil / Nursery & Landscaping	2	2
		2. Skill Based Subject	Soft Skill – I	3	2
				20	30

Semester - II

II	I	Language	Tamil - II / Hindi - II	3	6
	II	English	English – II	3	4
	III	Core - III	General Microbiology	4	6
		Core - IV	Practical – II (General Microbiology)	2	2

		Allied - II	Zoology - II	3	6
			Allied Zoology Practical	4	2
	IV	1. NME	Basic Tamil / Mushroom Cultivation	2	2
		2. Skill Based Subject	Soft Skill – II	3	2
				24	30

II Year

Semester - III

SEMESTER	PART	Course component	SUBJECT NAME	CREDIT	HRS.
III	I	Language	Tamil - III / Hindi - III	3	6
	II	English	English – III	3	4
	III	Core - V	Bryophytes & Pteridophytes	4	6
		Core - VI	Practical – III (Bryophytes & Pteridophytes)	2	2
		Allied - III	Chemistry – I	3	6
			Allied Chemistry Practical	-	2
	IV	1. Skill Based Subject	Soft Skill – III	3	2
		2. EVS	Environmental Science	-	2
				18	30

Semester - IV

IV	I	Language	Tamil - IV / Hindi - IV	3	6
	II	English	English – IV	3	4
	III	Core - VII	Gymnosperms, Paleobotany & Evolution	4	6
		Core - VIII	Practical – IV (Gymnosperms, Paleobotany & Evolution)	2	2
		Allied - IV	Chemistry - II	3	6
			Allied Chemistry Practical	4	2

	IV	1. Skill Based Subject	Soft Skill – IV	3	2
		2. EVS	Environmental Science	2	2
				24	30

III Year

Semester - V

SEMESTER	PART	Course component	SUBJECT NAME	CREDIT	HRS.
V	III	Core – IX	Cell Biology & Anatomy	4	4
		Core - X	Morphology, Taxonomy of Angiosperm & Embryology	4	4
		Core - XI	Practical – V (Cell Biology, Anatomy, Morphology, Taxonomy of Angiosperm & Embryology)	2	4
		Core - XII	Plant Biotechnology	4	4
		Core - XIII	Plant Physiology & Biochemistry	4	4
		Core - XIV	Practical – VI (Plant Biotechnology, Plant Physiology & Biochemistry)	2	4
		Elective - I	Plant Diseases & Management	5	5
	IV	Value Education	Value Education	2	1
				27	30

Semester - VI

VI	I	Core – XV	Genetics & Plant Breeding	4	5
	II	Core - XVI	Plant Ecology & Phytogeography	4	5
	III	Core - XVII	Plant Microtechnique	4	4
		Core – XVIII	Practical – VII (Genetics, Plant Breeding, Plant Ecology, Phytogeography & Plant Microtechnique)	4	6

		Elective – II	Herbal Science	5	5
		Elective – III	Horticulture	5	5
	V	Extension Activities		1	-
				27	30
Total Credits				140	

GURU NANAK COLLEGE (AUTONOMOUS) -CHENNAI – 42.

PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Course Structure

I Year

Semester - I

SEMESTER	PART	Course component	SUBJECT NAME	CREDIT	HRS.
I	I	Language	Tamil - I / Hindi - I	3	6
	II	English	English – I	3	4
	III	Core - I	Algae, Fungi & Lichens	4	6
		Core - II	Practical – I (Algae, Fungi & Lichens)	2	2
		Allied - I	Zoology – I	3	6
			Allied Zoology Practical	-	2
	IV	1. NME	Basic Tamil / Nursery & Landscaping	2	2
		2. Skill Based Subject	Soft Skill – I	3	2
				20	30

Semester - II

II	I	Language	Tamil - II / Hindi - II	3	6
	II	English	English – II	3	4
	III	Core - III	General Microbiology	4	6

		Core - IV	Practical – II (Microbiology)	2	2
		Allied - II	Zoology - II	3	6
			Allied Zoology Practical	4	2
	IV	1. NME	Basic Tamil / Mushroom Cultivation	2	2
		2. Skill Based Subject	Soft Skill – II	3	2
				24	30

II Year

Semester - III

SEMESTER	PART	Course component	SUBJECT NAME	CREDIT	HRS.
III	I	Language	Tamil - III / Hindi - III	3	6
	II	English	English – III	3	4
	III	Core - V	Bryophytes & Pteridophytes	4	6
		Core - VI	Practical – III (Bryophytes & Pteridophytes)	2	2
		Allied - III	Chemistry – I	3	6
			Allied Chemistry Practical	-	2
	IV	1. Skill Based Subject	Soft Skill – III	3	2
		2. EVS	Environmental Science	-	2
				18	30

Semester - IV

IV	I	Language	Tamil - IV / Hindi - IV	3	6
	II	English	English – IV	3	4
	III	Core - VII	Gymnosperms, Paleobotany & Evolution	4	6
		Core - VIII	Practical – IV (Gymnosperms, Paleobotany & Evolution)	2	2
		Allied - IV	Chemistry - II	3	6

			Allied Chemistry Practical	4	2
	IV	1. Skill Based Subject	Soft Skill – IV	3	2
		2. EVS	Environmental Science	2	2
				24	30

III Year

Semester - V

SEMESTER	PART	Course component	SUBJECT NAME	CREDIT	HRS.
V	III	Core – IX	Cell Biology & Anatomy	4	4
		Core - X	Morphology, Taxonomy of Angiosperm & Embryology	4	4
		Core - XI	Practical – V (Cell Biology, Anatomy, Morphology, Taxonomy of Angiosperm & Embryology)	2	4
		Core - XII	Plant Biotechnology	4	4
		Core - XIII	Plant Physiology & Biochemistry	4	4
		Core - XIV	Practical – VI (Plant Biotechnology, Plant Physiology & Biochemistry)	2	4
		Elective - I	Plant Diseases & Management	5	5
	IV	Value Education	Value Education	2	1
				27	30

Semester - VI

VI	I	Core – XV	Genetics & Plant Breeding	4	5
	II	Core - XVI	Plant Ecology & Phytogeography	4	5
	III	Core - XVII	Plant Microtechnique	4	4
		Core – XVIII	Practical – VII (Genetics, Plant Breeding,	4	6

			Plant Ecology, Phytogeography & Plant Microtechnique)		
		Elective – II	Herbal Science	5	5
		Elective – III	Horticulture	5	5
	V	Extension Activities		1	-
				27	30
Total Credits				140	

Semester – I

PAPER – I : ALGAE, FUNGI & LICHENS

Credit: 4

Objectives :

- *The main objective is to acquaint the students about morphology, biology and importance of algae fungi and lichens.
- * To provide knowledge on the structure and reproduction of certain selected algal, fungal and Lichen forms besides giving an overview.
- * To introduce students the economic importance of all groups.

Unit – I

General Characteristics – Habitat, habit. Cell structure – Prokaryotic and Eukaryotic. Reproduction – Vegetative, asexual and sexual. Life cycle patterns. Algal Classification – F.E. Fritsch, 1945.

Unit – II

Structure and reproduction with special reference to the following algal forms (no development) of (a) *Nostoc* (b) *Chlorella* (c) *Cyclotella* (d) *Sargassum* (e) *Gracilaria*. Economic Importance of Algae.

Unit – III

General Characteristics – Habit, Nutrition, Cell structure – Unicellular, Mycelial, Reproduction – Asexual, sexual, fruiting bodies. Lifecycle patterns. Fungal classification – Alexopoulos.

Unit – IV

Structure and reproduction with special reference to the following forms (no development) of (a) *Albugo* (b) *Saccharomyces* (c) *Puccinia* (d) *Agaricus* (e) *Colletotrichum*. Economic Importance of fungi.

Unit – V

Occurrence, structure and reproduction of Fruticose lichen - *Usnea*

PRACTICAL - ALGAE, FUNGI & LICHENS

Credit: 2

Micro preparation of the types prescribed in the syllabus.

Identifying the micro slides relevant to the syllabus.

Identifying types of algal mixture.

Morphological study of Algae, Fungi and Lichens.

Suggested Reading

1. Vashista Sinha B.R., Singh, V.P., 2002, Botany for Degree students, Algae 9th revised edition, S. Chand & Company Ltd., New Delhi.
2. Pandey B.P., 2000 Revised edition, Text Book of Botany Algae, S.Chand & Company, New Delhi.
3. Sharma O.P., 1992, Text Book of Algae, Tata McGraw Hill Publication Company Ltd., New Delhi
4. Chopra G.L., A Textbook of Fungi, S.Nagin & Co. Meerut, India
5. Pandey B.P., 1997 College Botany Vol. I Fungi & Pathology.
6. Mehrotra, R,S and Aneja, K.R.2003. An introduction to mycology. New age International (P) Ltd, Publishers, NewDelhi.

Semester – II

PAPER – II GENERAL MICROBIOLOGY

Credit: 4

Objectives :

*To provide information on the classification, growth, morphology and genetics of microbes and the recent advances in the field of microbiology. The role of microbes as beneficial and as pathogens is also studied.

*To understand the applied aspects of microbiology in dairy industries, pharmaceuticals, food and waste water.

Unit – I

History and scopes of microbiology. Mycoplasma - structure and multiplication. VAM fungi and their importance,

UNIT - II

Cleaning and sterilization of glassware, media Isolation techniques- Pour plate – Spread plate – Streak plate – Serial dilution – Types of culture media- staining techniques – simple and differential staining Control of microbes – physical, chemical and biological methods

Unit – III

Bacteria - Classification (Bergey's Manual) Ultrastructure and nutrition.
Bacterial genetics – Transformation, Transduction and Conjugation

Unit – IV

General characteristics – structure, replication and viruses of animals, plants, bacteriophage and human, mode of transmission

Unit – V

Microbiology of foods – food spoilage, food preservation
Industrial Microbiology – Lactic acid, Citric acid, Alcohol beverages,
Medical Microbiology - Antibiotic production – Penicillin and Streptomycin.

PRACTICAL - GENERAL MICROBIOLOGY

Credit : 2

Cleaning and sterilization of glassware.

Preparation of different types of culture media.

Isolation of pure culture – streak, spread and pour plate methods.

Staining of bacteria – Simple staining, Gram staining.

Photographs of micro organisms prescribed in the syllabus.

PRACTICAL – I : PAPER – III (Algae, Fungi, Lichens & General Microbiology)

Suggested Reading

- 1.Adams, M.R. and M.O. Moss. 1995.Food microbiology . New Age International (p) Ltd., Chennai.
- 2.Agarwal, 2006. Industrial Microbiolgy: Fundamentals and Application, IBD publishers,, New Delhi.
- 3.Ananthanarayanan, R and C.K.J. Panikar. 2000. Text book of Microbiology, 6th Edition, Orient Longman.
- 4.Atlas, R.M. 1989. Microbiology- Fundamental and Applications. McMillan Publishing Company. New York.
- 5.Cruger F. and Anneliese Crueger, 2000. Biotechnology: Industrial Microbiology. Panima Publications.
- 6.O.P Sharma, 2011. Fungi and Allied microbes. Tata McGraw Hill Pvt. Co.
- 7.P.D. Sharma, 2005. Fungi and Allied organisms. Narosa Publishing house Ltd.
- 8.George N., Agrios. 2008. Plant pathology. V edition, Academic Press.
- 9.P.D. Sharma, 2006. Plant pathology. Narosa Publishing house Ltd.
- 10.Mehrotra , 2008. Plant Pathology Tata McGraw Hill Pvt. Co.
- 11.Madigan, M.T. and J.N. Martinko. 2006. Brock Biology of Microorganisms.11th edition,Pearson Education, inc.Upper Saddle River, USA
- 12.Mackane, L. and J. kandel, 1996. Microbiolgy-Essential and applications. McGraw Hill Inc., New York.

Semester – III

PAPER – IV BRYOPHYTES & PTERIDOPHYTES

Credit: 4

Objectives:

*To build up a sound foundation in cryptogamic botany in general and to acquaint the students about classification, morphology, biology and economic importance of various bryophytic plants and ferns.

*To provide knowledge on the comparative studies of steles, sporangia and gametangia in eusporangiate and leptosporangiate groups.

Unit – I

General Characteristics – Habitat – Habit – Gametophyte – Sex organs – Sporophyte – Alternation of Generations & life cycle.

Unit – II

Detailed study of structure and reproduction of

a) *Marchantia* b) *Anthoceros* c) *Polytrichum* (No developmental studies)

Unit – III

General characteristics – Classification (Reimer's 1954) – Apogamy & Apospory – Homospory & Heterospory – Origin and evolution of Pteridophytes.

Unit – IV

Detailed study of structure and reproduction in the following forms (no developmental aspects)

a) *Lycopodium* b) *Equisetum* c) *Adiantum* d) *Marsilea*.

Unit – V

Stelar system in Pteridophytes – Heterospory and seed habit, Economic Importance of Pteridophytes.

PRACTICAL – BRYOPHYTES AND PTERIDOPHYTES

Credit : 2

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Bryophyte genera included in the theory syllabus.

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Pteridophyte genera included in the theory syllabus.

Suggested Reading

- 1.Eames.A, 1963 – Morphology of lower vascular plant, McGraw Hill
- 2.Forster and Gifford, 1959 – Comparative morphology of vascular plants.
- 3.Pandey B.R., 1977 – A text book of Botany, Pteridophytes and Gymnosperms, K. Nath & Meerut.
- 4.Parihar. N.S., 1967 – An introduction of Embryophyta, Vol.III – Pteridophyta, Central book depot, Allahabad.
- 5.Smith.G.M., 1955- Cryptogamic Botany, Volume-II– McGraw Hill
- 6.Sporne.K.L., 1976 – Morphology of Pteridophytes, 4th edition, B.I.Publication.
- 7.Vashista.P.C., 1971 – Botany for Degree students : Pteridophyta. S.Chand&Co.
- 8.Watson, E.V. The structure and Life of Bryophytes
- 9.Prem Puri. 1973. Bryophytes-A broad perspective, Atma Ram & Sons, New Delhi
10. Parihar, N.S. 1991. Bryophytes. Central Book Depot, Allahabad.
11. Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
12. Puri, P. 1980. Bryophytes. Atma Ram & Sons, New Delhi.
13. Sporne, K.R. 1991. The Morphology of Pteridophytes. B.I. Publ. Pvt. Ltd.

Semester – IV

PAPER – V - GYMNOSPERM, PALEOBOTANY & EVOLUTION

Credit: 4

Objectives:

*To acquaint the students about the latest trends in classification, vegetative morphology and reproductive biology of gymnosperms.

*To provide knowledge on the detailed study of fossils, its kinds and the geological time scale.

*Takes into account the concept of: origin of life and theories associated with it.

Unit – I

General Characters – Distribution – Morphology – Structure and reproduction of Gymnosperms – Classification of Sporne (1954).

Unit – II

Detailed study of structure and reproduction (no developmental aspects) of
a) *Cycas* b) *Pinus* c) *Gnetum*.

Unit – III

Introduction – fossils – process of fossilization (preservation) – types of fossils - unaltered (Coal, Ice embedded fossils and embedded in Amber) and altered (Compression, petrification, impressions, moulds and casts) – Geological Time Scale.

Unit – IV

Father of Indian Paleobotany (Birbal Sahni and its contribution). Study of the following fossil form genera a) *Lepidodendron* b) *Lepidocarpon* c) *Calamites* (Fossil Pteridophytes)
d) *Williamsonia* (fossil Gymnosperm).

Unit – V

Origin of Life – Chemosynthetic theory of origin of life – Evolutionary theory of Lamarck and Charles Darwin Theory.

PRACTICAL – GYMNOSPERMS, PALEOBOTANY AND EVOLUTION

Credit : 2

Study of morphology, anatomy of the vegetative and reproductive organs of *Cycas*, *Pinus* and *Gnetum*.

Fossil slides of *Lepidodendron*, *Lepidocarpon*, *Calamites* & *Williamsonia*

Photographs of Evolution scientists.

PRACTICAL – II : PAPER – VI (Bryophytes, Pteridophytes, Gymnosperms, Paleobotany & Evolution)

Suggested Reading

1. Sporne. K.R., 1954- Morphology of Gymnosperms, Hutchinson University Library.
2. Gupta. M.N., 1972, - The Gymnosperms (2nd Edition) Shiva Lal Agarwala & Co., Agra.
3. Vashista, P. C., 1976, Gymnosperms, S.Chand & Co.
4. Sporne, K.R. 1991. The Morphology of Gymnosperms. B.I. Publications, New Delhi.
5. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms, New Age Int. Pvt. Ltd., New Delhi
6. Stewart, W.N. and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.

Semester - V

PAPER – VII CELL BIOLOGY & ANATOMY

Credit: 4

Objectives :

- * To acquaint the student about the anatomical and cytological studies of various plant groups.
- *To make the student understand the organization of prokaryotic and eukaryotic cell, structure and function of cell organelles including cell division.
- * To expose the student to understand the plant cell, tissues, and internal structures of stem, root and leaves including their anomalies.

Unit – I

Cell Theory – Cell Organelles – Plasma Membrane, Ribosomes, Golgi apparatus, Endoplasmic Reticulum, Lysosomes, Peroxisomes, Mitochondria and Chloroplast.

Unit – II

Nucleus, Nuclear Membrane, Chromosomes – Euchromatin , Heterochromatin - Types of Nucleic Acids. Giant Chromosome (Polytene and Lamp Brush Chromosome), Cell Division (Mitosis and Meiosis).

Unit – III

Plant Cell Structure – Nature of Plant cell wall, tissue and tissue system – Meristematic tissues, Permanent tissues and secretory cells.

Unit – IV

Meristems – types of meristems – apical meristem – theories – Apical cell theory, tunica corpus theory and histogen theory. Differentiation of stem, leaf and root, vascular bundle and vascular cambium.

Unit – V

Structure of Dicot stem – primary and secondary structure – structure of dicot root – primary and secondary, monocot stem, structure of monocot root, nodal anatomy, leaf anatomy –

Dorsiventral and Isobilateral, stomatal types. Anomalous secondary growth (Dicot – Nyctanthes, Boerhaavia, Monocot – Dracaena).

Suggested Reading

1. Verma, P.S. & V.K. Agarwal, 2002, Cytology. S. Chand & Co.Ltd., New Delhi-55.
2. Verma, P.S. & V.K. Agarwal, 2003, Genetics. S. Chand & Co.Ltd., New Delhi-55.
3. Freifelder, D. 1987. Essentials of Molecular Biology, Jones & Bartlett, Boston.
4. Gardner, E.J., Simmons, M.J. & Snustad, D. 1991. Principles of Genetics, John Wiley & Sons Inc., 8th Edn., New York.
5. Sinnott, E.W., Dunn, L.L. & Dobzhansky, T. 1997. Principles of Genetics, Tata Mc Graw Hill Publishing Co., New Delhi.
6. Brown W.V. and Bertke E.M., 1974, A text book of Cytology C.V. Mosley Co., St. Louis.
7. Cohn N.S., 1979, Elements of Cytology, Freeman Book Co.,
8. De Robertis E.D.P. and DeRobertis. E.M.F. jr 1987 – Cell and Molecular biology Lea and Febiger..
9. Feifelder D., - Molecular Biology, Narosa. Publication
10. Watson. J.D., et.al Molecular biology of the Gene The Benjamin/ Cummings.
11. Freifelder, D. 1987. Essentials of Molecular Biology, Jones Bartlett, Boston, USA.
12. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
13. Gardner, E.J., Simmons, M.J. & Snustad, D. 1991. Principles of Genetics, 8th Edn., John Wiley & Sons Inc., New York.
14. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular, Biology and Biotechnology. CRC Press, Boca Raton, Florida.
15. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant. DNA Techniques : Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.
16. Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK.
17. Harris, N. and Oparka, K.J. 1994. Plant Cell Biology : A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
18. Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press Oxford.
19. Esau K. (1985) – Anatomy of Seed Plants – John Willey
20. Cutter E.G (1989) – Plant Anatomy – Part I – Addison – Wesley Publishing Co..
21. Vashista P.C. (1988) – A Text Book of Plant Anatomy. S. Nagin & Co.
22. Fageri, K. and Van der Pijl, L. 1979. The Principle of Pollination Ecology. Pergamon Press, Oxford.
23. Fahn, A. 1982. Plant Anatomy. (3rd edition). Pergamon Press, Oxford.

Semester – V

PAPER – VIII MORPHOLOGY, TAXONOMY OF ANGIOSPERM & EMBRYOLOGY

Credit: 4

Objectives:

- * To acquaint the students about the basic principles involved in classification, naming and identification of angiospermic plants.
- * To expose the students to the diagnostic features of selected families and to know the economically important plant products and their utilization.
- * To understand the lifecycle of angiospermic plant development and the various processes that are involved.

Unit – I

Morphology – root system – modifications. Shoot system – modifications – (Aerial, sub-aerial and underground). Leaf-simple and compound- phyllotaxy, modifications, (phyllode, pitcher) tendrils, stipules. Inflorescences – definition and types – racemose, cymose, mixed and special types. Fruits - classification.

Unit – II

Taxonomy and its importance, Concept of a Taxon – Genus and Species, Author citation, Binomial Nomenclature, ICBN, Taxonomic Hierarchy and Herbarium Techniques. Systems of Plant Classification – Artificial (Linnaeus), Natural (Bentham & Hooker), Modern and Phylogenetic (Cronquist). Merits and Demerits.

Unit – III

Detailed study of following Angiospermic families

Dicot

Polypetalae : a) Capparidaceae b) Leguminosae c) Cucurbitaceae

Gamopetalae :d) Rubiaceae e) Apocynaceae f) Solanaceae

Monochlamydeae : g) Euphorbiaceae

Monocot : h) Poaceae

Unit – IV

Development of anther - Microsporangium – Microsporogenesis, Microspores, male gametophyte.

Development of ovule – Megasporogenesis, female gametophyte (Monosporic – *Polygonum*, Bisporic – *Allium*, Tetrasporic – *Peperomia*).

Unit – V

Fertilization – Double fertilization, triple fusion, Endosperm and its types (Cellular, Nuclear and Helobial), development of dicot embryo (*Capsella*), development of monocot embryo (*Najas*), polyembryony, apomixis – definition and types.

Suggested reading

1. Lawrence.G.H.M, 1985 – An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Porter.C.L., 1982 – Taxonomy of Flowering Plants, Eurasia Publications House, New Delhi
- Rendle.A.B., 1980 – The Classification of Flowering Plants (Vol. I & II), Vikas Students Education.
3. Pandey.B.P., 1987 – Taxonomy of Angiosperms.
4. Clive AS.1989. Plant Taxonomy and Biosystematics, Chapman and Hall Inc. New York.
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39. Shivanna, K.R. and Johri, B.M. 1995. The Angiosperm Pollen : Structure and Function. Wiley Eastern Ltd.. New York.

Semester – V

PAPER – IX - PLANT BIOTECHNOLOGY

Credit: 4

Objectives:

- * To understand the fundamental aspects of plant tissue culture and molecular biology of plants for the production of transgenics.
- * To understand the concepts of modern technology pertaining to large scale production of agricultural products.

Unit – I

Biotechnology – definition, history and scope. Isolation and cultivation of economically important microbes (a) Fresh Water Alga (*Scenedesmus*) (b) Fungus (*Aspergillus*).

Unit – II

Tissue Culture – *In vitro* culture techniques : Sterilization Methods, Culture Media – Composition and types of medium, inoculation, incubation and acclimatization. Callus formation and protoplast fusion with reference to improvement of plants. Somoclonal variation and cryopreservation.

Unit – III

Single cell protein (SCP) – Micro-organism used in SCP (*Scenedesmus* and *Spirulina*). Nutritional value of SCP. Algal Biomass production and maintenance.

Biofertilizers – Blue green algae, *Azolla*, Fungi – *Mycorrhiza* (VAM and Ectomycorrhiza), Bacterium – *Azospirillum* and *Rhizobium*.

Unit – IV

Production of primary metabolites – ethanol production by Yeast, citric acid production by *Aspergillus niger*. Production of secondary metabolites - antibiotics – *Pencillin*. Enzymes from microbes and their application – amylase, proteases, renin, pectinase and glucose oxidase. Improvement of plants : alkaloid production, vaccine production luminescent plants and protein sweetener.

Unit – V

Principles and tools of Genetic Engineering –Restriction enzymes, Cloning vectors, Gene delivery system : Plant Viruses, *Agrobacterium* mediated gene transfer (biological), Particle gun bombardment, microinjection, electrophoration. Production of transgenics : disease resistant plant (*Bt* gene).

Suggested reading

1. Bernard R Glick & Jack J Pasternak. 2001. Molecular biotechnology-principles and applications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
 2. Jogdand, SN. 1997. Gene biotechnology, Himalaya Publishig House, New Delhi.
- Books for Reference
3. Ernst L. Winnaccker, 2002. From Genes to Clones-introduction to gene technology, VCR Pub., Weintein.
 4. James D Watson et al., 1992. Recombinant DNA (2nd Edition), WH Freeman and Co., New York.
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 9. Bajaj, Y.P.S. (1987). Biotechnology in agriculture and forestry. Springer – Verlag
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 12. Mantell, S.H., and Hedsmith, 1983. Plant biotechnology, SEB Seminar series 18, Cambridge University Press, Cambridge.
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 14. Mizrahi, A., (1988). Biotechnology in agriculture, advances in biotechnological

- processes, Vol. 9, Alen R. Liss Loc; New York.
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 16. Thorpe, T.A., 1978. Frontiers of plant tissue culture. University of Calgary Publication.
 17. Hu, C.Y. and P.J.Wang, 1984. Hand book of plant cell culture Vol.1. Mac millan, New York.
 19. Reinert, J. and Y.P.S.Bajaj, 1977. Applied and fundamental aspects of plant cell – tissue culture and organ culture – Springer – Verlag, Heidelberg, Berlin.
 20. Gleba, Y.Y. and Sytnik, K.M. (1984). Genetic engineering in higher plants – Springer – Verlag, Heidelberg.
 21. Bhajwani. S., and Razdan, 1984. Plant tissue culture. Theory and practice.

Semester – V

Paper – X - PLANT MICROTECHNIQUE

Credit: 4

Objective:

1. To study the objects for examination under a microscope through various techniques.
2. To study the methods and procedures in the structure, vital activity, development, chemical composition, and physical properties.

Unit I. Light microscopy – History and - Optical principles use and care of Microscopes - A brief

Survey of different types of microscopes including E.M.

Unit II. Microtechnical processes – principles and techniques:

(A) Fixation and Fixatives

(B) Temporary staining and stains

Unit III. Microscopic preparation, Semipermanent and Permanent.

Unit IV. Special techniques : smear, squash & maceration

Unit V. Microtomy: types of microtomes and their use.

Methods of specific materials:

(A) Whole mount of algae & fungi

(B) Sectioning of bryophytes , pteridophytes and gymnosperms.

(C) Maceration & sectioning of angiosperm materials.

Suggested reading

1. Alan peacock H.1966 Elementary Microtechnique Edward Arnold (Pub) Ltd.
2. Duddington - C.L. 1960 Practical Microscopy, Pitinan.
3. Cray P.Hand Book of Basic Microtechnique. Mac - Graw Hill, New Delhi.
4. Johnson D.A. 1940 Plant Microtechnique. Mac - Graw Hill, New Delhi.
5. MC Clung, C.L.1961, Hand book of Microscopical Technique.
6. Patki L.R.1992 An Introduction to Microtechnique S.Chand & Company, New Delhi.
7. Prasad & Prasad 2000 Emkay Replications, Delhi.
8. Puru's M.J.et al 1966 Laboratory Techniques in Botany Butter Worths.

PRACTICAL – III : PAPER – XI - CELL BIOLOGY, ANATOMY, MORPHOLOGY, TAXONOMY OF ANGIOSPERM, EMBRYOLOGY, PLANT BIOTECHNOLOGY & PLANT MICROTECHNIQUE

CELL BIOLOGY

Squash and Smear techniques.

Ultra structure of Plant cell and cell organelles with the help of ultra-microphotograph.

ANATOMY

Study of internal structure of primary (young) and secondary (Old) stems

Internal structure of monocot stem and root T.S. of dicot and monocot leaf. Stomatal types

Anomalous secondary growth in the stem of *Nyctanthes*, *Boerhaavia* and *Dracaena*

MORPHOLOGY, TAXONOMY OF ANGIOSPERM

Morphology of root, stem, leaves and modifications, types of inflorescence and fruits.

Plants of local flora included under theory syllabus and family identification and derivation based on reasoning.

Dissection, identification, observation and sketching the floral parts of the plants belonging to the families included in the syllabus.

Ten (10) Herbarium sheets and field note book to be submitted.

Economic uses of plants and plant parts included under theory syllabus.

Field trips to places for observation, study and collection of plants prescribed in the syllabus for 2 to 5 days under the guidance of faculties.

EMBRYOLOGY

T. S. of young and mature anther – (Permanent slides only)

Types of ovules, different stages of embryo sac development

Types of Endosperm : Cellular, Nuclear and Helobial.

Stages and the development of dicot embryo (*Capsella*) & monocot embryo (*Najas*).

Dissection and display of any two stages of embryo in *Tridax*.

PLANT BIOTECHNOLOGY

Sterilization techniques in plant tissue culture

Preparation of MS Medium, Embryo culture, Meristem culture and Anther culture

Study of algal biofertilizers, VAM fungi, Bacteria – *Azospirillum*

PLANT MICROTECHNIQUE

1. Microscopic preparation of Semi-permanent and Permanent slides.
2. Special techniques : smear, squash & maceration.

Semester – V

ELECTIVE – I : PLANT DISEASES & MANAGEMENT

Credit: 5

Objectives:

1. To study about the plant diseases with special reference to southern India.
2. To understand the diseases, symptoms, causal organisms – etiology of the diseases and control measures.

Unit – I

Plant Diseases : Introduction, Concept, Importance, History and classification. Basic concept of infection – inoculum, inoculum potential, penetration, infection, invasion, growth, reproduction and dispersal.

Unit – II

Defence mechanism – ***Innate*** : surface structure, structure of natural openings, inhibitors, suberized, lignified tissue – gum deposition – phenols – phenolic glycosides. ***Induced*** : hypersensitivity - histological – cork – abscission – biochemical phenols and phytoalexins. Fundamental concepts on cross protection and induced resistance.

Unit – III

Study of the following diseases with reference to their incitants, symptom manifestation and control measures. Smut of Sorghum, Rust of Wheat, Downy mildew of Grapes, Bacterial blight of rice, Wilt of cotton, club root of cabbage.

Unit – IV

Study of casual organisms and symptoms of

1. Blast diseases of rice
2. Red rot of sugarcane

3. Tikka disease of groundnut
4. Citrus canker
5. Leaf curl of Papaya
6. TMV
7. Insect diseases - Plant galls
8. Parasitic diseases of plants - *Cuscuta*

Unit – V

Modern methods of disease forecast – epiphytotic – causes, course, decline and prophylaxis; Detection of plant pathogens using molecular tools. Plant protection – Prevention, eradication - environmental, chemical and biological.

Suggested reading

1. Bilgrami, K.S. and Dube, H.C. 1976. A text book of modern plant pathology. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Pandey B.P. 1989. A text book of plant pathology, pathogen and plant diseases. S. Chand and Company Ltd., New Delhi.
3. Mukerji, K.G. & Bhasin, J. 1972. Plant diseases of India – A source book. Tata McGraw Hill, New Delhi.
4. Mehrotra. R.S. 1980. Plant pathology. Tata McGraw Hill, New Delhi.
5. Rangaswamy, G. 1975. Diseases of crop plants in India. 2nd Edn. Prentice Hall, India

Semester – VI

PAPER – XII GENETICS & PLANT BREEDING

Credit: 4

Objectives:

1. To understand the principles of genetics and transfer of hereditary characters.
2. To make the student to understand the mechanisms of gene expression and its regulation.
3. To understand the process of crop improvement and hybridization.

Unit – I

History, branches and application, Mendelian genetics –Mendel's experiment, Mendel's laws. Monohybrid cross and its modification, dihybrid cross and test cross.

Unit – II

Allelic and non-allelic interactions. Chromosome theory of linkage, crossing over, recombinations and mapping of genes on chromosomes. Polygenic inheritance, Multiple alleles.

Unit – III

Chromosomal aberrations – duplication, deletion, inversion and translocation, sex linkage, Sex determination in plants. Polyploidy origin, types and significance.

Unit - IV

Extra nuclear inheritance and its significance. Male sterility in corn. Mutation – types, mutagenic agents (physical and chemical) and significance. Population genetics – Hardy Weinberg principles.

Unit – V

Principles involved in plant breeding, methods of crop improvement – selection (pure line, mass and clonal). Hybridization : types, selection of parents, emasculation, bagging, heterosis, introduction and acclimatization.

Suggested reading

1. Verma, P.S. & V.K. Agarwal, 2002, Cytology. S. Chand & Co.Ltd., New Delhi-55.
2. Verma, P.S. & V.K. Agarwal, 2003, Genetics. S. Chand & Co.Ltd., New Delhi-55. Freifelder, D.1987. Essentials of Molecular Biology, Jones & Bartlett, Boston.
3. Gardner, E.J., Simmons, M.J. & Snustad, D. 1991. Principles of Genetics, John Wiley Sons Inc., 8th Edn., New York.
4. Sinnott, E.W., Dunn, L.L. & Dobzhansky, T. 1997. Principles of Genetics, Tata Mc Graw Hill Publishing Co., New Delhi.
5. Brown W.V. and Bertke.E.M., 1974, A text book of Cytology C.V.Mosley Co.,St. Louis.
6. Cohn.N.S., 1979, Elements of Cytology, Freeman Book Co.,
7. De Robritis E.D.P. and DeRobrities. E.M.F.jr 1987 – Cell and Molecular biology Lea and Febiger..
8. Feifelder.D., - Molecular Biology, Narosa. Publication
9. Watson. J.D., et.al Molecular biology of the Gene The Benjamin/ Cummings.
10. Freifelder, D. 1987. Essentials of Molecular Biology, Jones Bartlett, Boston, USA.
11. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College,Philadelphia, USA.
12. Gardner, E.J., Simmons, M.J. & Snustad, D. 1991. Principles of Genetics, 8th Edn., John Wiley & Sons Inc., New York.
13. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular, Biology and Biotechnology. CRC Press, Boca Raton, Florida.
14. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant. DNA Techniques : Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.

15. Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK.
16. Harris, N. and Oparka, K.J. 1994. Plant Cell Biology : A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
17. Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press Oxford.

Semester – VI

PAPER – XIII PLANT ECOLOGY & PHYTOGEOGRAPHY

Credit: 4

Objective:

1. To give an insight into ecology, environmental pollution and microbial processes in the environment.
2. To introduce the students to the essential basics of phytogeography and forestry of India.

Unit – I

Biotic and abiotic factors and their influence on vegetation – a brief account of microbes, plants, animals, soil, wind, light, temperature, rain fall and fire. Plant succession – Primary and secondary – Xerosere, Hydrosere. Adaptation in xerophytes, hydrophytes and epiphytes.

Unit – II

Ecosystem – Concept processes and components. Food chain, food web, energy flow in ecosystem. Types of Ecosystems : Coastal and grassland. Ecological pyramids and nutrient cycling.

Unit – III

Ecological species and genetic species diversity, concept : classical and modern. Allopatric and sympatric speciation.

Unit IV

Biodiversity: Principles and need for conservation - in situ and Ex situ, Endemism. Endangered plants

Unit V

Phytogeographic regions of India – Ever green forests, Deciduous forests, Scrub jungle and Mangrove forests.

Suggested reading

1. Atlas. R.M. and Bartha.R. (1987) – Microbial Ecology : Fundamentals and applications. The Benjamin/ Cummings Publishing Co. Inc.
2. Colinviaux.P. (1986) – Ecology, John Wiley and Sons.
3. Kumar.H.D. (1990) – Modern concepts of Ecology, Vikas Publishing House Pvt. Ltd.,
4. Krishna Iyer.V.R (1992) Environmental protection and legal defence. Sterling Publishers Pvt. Ltd.,
5. Mabberley.D.J. (1983) – Tropical Rain forest ecology, Blackie and Son Ltd.,
6. Odum.E.P. (1983) – Basic Ecology, Holt-Saunders International Editions.
7. Shukla.R.S. and Chandel.P.S. (1990) – Plant Ecology, S.Chand & Co. Pvt. Ltd.,
8. Singh.D.V (1985), The Eco Vote : - People's representatives and global environment.
9. Smith.W.H. (1981) – Air pollution and forest : Interactions between air contaminants and forest ecosystems.
10. Vickery.M.L. (1984) – Ecology of Tropical plants, John Wiley and Sons.
11. Krishnamurthy KV. 2003. An advanced text book on Biodiversity - Principle and Practice. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
12. Melchias, G., 2001. Biodiversity and Conservation, Science Publishers Inc. USA.
13. Sharma, PD. 1999. Ecology and Environment, Rastogi Publishers, Meerut.
14. Asthana, DK & Meera Asthana. 2006. A text book of Environmental studies. S.Chand & Company Ltd. New Delhi.
15. Brian Groombridge. 1992. Global Biodiversity, Chapman and Hall, UK.
16. IUCN, 1985. The World Conservation Strategy, IUCN, Switzerland.
17. Odum, EP. 1970. Fundamentals of Ecology, 3rd edn, W.B.Saunders Ltd., UK
18. Simmons et al., 1980, Conservation of Threatened Plants, NATO Scientific affairs, New York.

Semester – VI

PAPER – XIV PLANT PHYSIOLOGY & BIOCHEMISTRY

Credit: 4

Objectives:

1. To provide an insight into the physico-chemical organization and the functional aspects of plants.
2. To orient the students to understand effectively the concepts on morphogenesis and ultimately plant biochemistry.

Unit – I

Atomic structure, chemical bonds – ionic bond and covalent bond, pH, buffers and electrolytes. Water relations – movement of water from soil to plant, Apoplast and Symplast. Stomatal physiology – types of transpiration in plants and Guttation.

Unit – II

Deficiency and symptoms – Absorption and translocation of solutes – active & passive uptake. Enzymes: Classification, properties and mode of action.

Unit – III

Photosynthesis – Chloroplast pigments, Energy sources, Photosystem I & II, electron flow through cyclic and non-cyclic photophosphorylation – pathways of CO₂ fixation in C₃ and C₄ plants.

Unit – IV

Respiration – Glycolysis, Krebs cycle, electron transport system, oxidative phosphorylation, respiratory quotient. Anaerobic respiration and fermentation.

Nitrogen assimilation – importance of nitrogen in plant life, biological nitrogen fixation, legume – *Rhizobium* symbiosis.

Unit – V

Growth – Plant growth regulators (Auxins, Gibberellic acid, cytokinin and Ethylene) – mechanism of action and practical applications.

Physiology of flowering : Photo periodism – Vernalisation. Seed – Dormancy, viability and germination.

Suggested reading

1. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.
2. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (Eds) 1997. Plant Metabolism (second edition). Longman Essex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.
4. Hooykaas, P.J.J., Hall M.A. and Libbenga, K.R. (eds) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands.
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
6. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (fourth edition). W.H. Freeman and Company, New York, USA.
7. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag, New York, USA.
8. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.
10. Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee 1999., Concepts in Photobiology : Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
11. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
12. Thomas, B. and Vince-Prue, D. (1997) Photoperiodism in Plants (second edition). Academic Press, San Diego. USA.
13. Westhoff, P. (1998) Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK.
14. Jain, J.L. 1979. Fundamentals of Biochemistry, Chand & Co. Ltd., New Delhi
15. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand&Company Ltd.,
16. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi

17. Conn, E & Stumpf, PK. 1979. Outline of Biochemistry Niley Easdtern Ltd., New Delhi
18. Metz, ET. 1960. Elements of Biochemistry. V.F & S (P) Ltd., Bombay
19. Noggle and Fritz, 1976. Introductory Plant Physiology, Prentice Hall, New Delhi
20. Pandey, SN & Sinha, BK. 1989. Plant Physiology, Vikas Publishing House Ltd., New Delhi
21. Robert M. Devlin. 1970. Plant Physiology, East West Press, New Delhi

PRACTICAL - IV : PAPER – XV - GENETICS, PLANT BREEDING, PLANT ECOLOGY, PHYTOGEOGRAPHY, PLANT PHYSIOLOGY, BIOCHEMISTRY

Genetics and Plant Breeding

Genetics problems : Monohybrid cross, dihybrid cross, test cross and its modification.

Allelic and non-allelic interactions.

Gene Mapping : Three point test cross

Hybridization Technique.

Plant Ecology, Phytogeography

Study of morphological and structural adaptations of

Xerophyte : Nerium, Casurina

Hydrophyte : Nyphaea, Hydrilla

Epiphytes : Vanda

Map of Phytogeographical regions of India.

Plant Physiology

Experiments to be performed and recorded by students individually:

1. Determination of water potential by plasmolytic method.
2. Determination of water potential by gravimetric method.
3. Effect of temperature and chemicals on membrane permeability.
4. Study of rate of transpiration under different environmental factors.
5. Separation of plant pigments by paper chromatography.
6. Study of rate of photosynthesis under different light intensities.
7. Study of rate of photosynthesis under different wavelengths of light.
8. Measurement of pH of expressed cell's sap and different soils using pH Meter.

Demonstration – Experiments

1. The relationship between Transpiration and Absorption
2. Determination of RQ using Ganong's Respirometer

Semester – VI

ELECTIVE II : HERBAL SCIENCE

Credit: 5

Objectives:

1. To know the elementary treatment of various morphological, anatomical and biochemical parameters used in the identification and utilization of medicinal plants in general.
2. To provide an overview of ethnobotany, methods of herbal preparation, tribal medicine and their importance in present day drug research.

Unit – I

Introduction, Food Plants – Plant and Plant products of Industrial value. Cereals – Rice & Wheat, Millet – Sorghum & Pearl millet, Pulses – Soya bean, Nuts – Peanut.

Unit – II

Fibers and fiber yielding plants – Cultivation, extraction and uses of Fibres.

Soft fibres – *Corchorous*, Hard fibre – Manila Hemp – *Musa textilis*, Surface fibre – *Gossypium*.

Timber – Harvesting & processing of wood in *Tectona*.

Rubber – Extraction & processing with reference to *Hevea brasiliensis*.

Unit – III

Sugar – *Saccharum officinarum* – cultivation, harvesting and extraction.

Spices – *Eugenia caryophyllata* – cultivation & harvesting.

Beverages – *Coffea arabica* & *Thea sinensis* – cultivation & harvesting.

Pulp and paper – raw materials & manufacture of pulp.

Unit – IV

Definition, history and scope of Pharmacognosy.

Indigenous systems of medicine – Ayurvedic, Siddha, Unanai and Homeopathy.

Unit – V

Sources, descriptions, constituents and uses of the following:

Antirheumatic – *Colchicine*

Antitumour – *Vinca*

Antidiabetic – *Gymnema*

Antiseptic – Neem

Suggested reading

1. Text book of Pharmacognosy, Wallis, T.E. 1999. CBS Publishers and Distributors, New Delhi.
2. Practical Pharmacognosy, Kokate. 2000. Vallabh, New Delhi.
3. Herbal cure for common diseases. Acharya Vipul Rao, 2000. Diamond books, Pvt. Ltd.
4. Indian medicinal plants used in Ayurvedic preparations, Dey. A.C. 1998. Bishen Singh Mahendra pal singh.
5. Herbal drug microscopy. Vasudevan, T.N. and Laddha, K.S. 2003. Yucca Pub. House.

Semester – VI

ELECTIVE – III : HORTICULTURE

Credit: 5

Objectives:

- *To acquaint the students about the basics of plant propagation, irrigation methods, manures and organic farming.
- * To provide the students a theoretical knowledge of horticulture so as to establish home gardens scientifically.
- *Introduce the methodology of food processing.

Unit – I

Brief history of horticulture, horticultural classification, horticultural crops. Economic importance : Essentials of nursery Management – Soil management: Garden soil, physical and chemical properties of soil, organic matter, compost, cultural practices, water management : Water quality, irrigation, mulching, nursery structures : Protected cultivation (greenhouses), environment controls.

Unit – II

Hydroponic culture – types of container. Use of manures and fertilizers in Horticultural crop production. Organic farming. Environment factors influencing vegetable and fruit production.

Unit – III

Horticultural crops protection – physical control, pruning. Biological control, chemical control – pesticides, fungicides and insecticides.

Unit – IV

Plant propagation – cutting, layering, grafting. Indoor gardening. Orcharding vegetable farming, floriculture, ornamental gardening and landscape horticulture.

Unit – V

Technology of horticultural crops – market preparation: harvesting and handling packaging and transport, storage, chemical treatment. Food processing – freezing, bottling and canning, drying and chemical preservation.

Suggested reading

1. H.T. Hartmann and D.E. Kester 1989. Plant propagation – principles and practices. Half of India New Delhi.
2. T.K. Bose and Mitra and Sadhu, 1991. propagation of tropical and subtropical horticultural crops. Naya Prakash.
3. Singh S.P 1989 Mist propagation Metropolitan book Co., New Delhi.
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- Mc Daniel, G.L., 1982. Ornamental horticulture. Reston Publ., London.
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21. Trivedi, P.P., 1983. Home gardening, ICAR, New Delhi.
22. Helleyer, A., 1976. The Collingridge Encyclopedia of gardening Chartwell Book, Inc., New Jercey.
23. Bailey, L.H., 1963. The Standard Encyclopedia of Horticulture. Mc Million & Co., London.
24. Bose, T.K., and Mukharjee, D., 1977. Gardening in India. Oxford & IBH Pub., Co., Calcutta.
25. Gopalswamy Iyyangar, 1970. Complete gardening in India, Kalyan Printers, Bangalore
26. Rangaswami, G. and Mahadevan, A. 1999. Diseases of Crop Plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi.

Semester – I

NME - NURSERY AND LANDSCAPING

Credit : 2

Objectives

1. To expose the students to the principles of vegetative propagation.
2. To provide the students a theoretical knowledge to establish home gardens scientifically.

UNIT - I

Introduction, prospects and scope of Nursery and landscaping.

UNIT - II

Methods of Propagation – cutting, layering, grafting, budding, Floriculture – Rose, Chrysanthemum, Jasmine – cultivation.

UNIT III :

Gardening – formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn.

UNIT IV :

Nursery structures – Green house – shade house, Mist chamber – topiary, Bonsai culture.

UNIT V:

Manure, composting - Vermicomposting

Suggested reading

1. Edmond Muser and Andres. Fundamentals of Horticulture, McGrawHill Book co.,
2. Gardener, Basic Horticulture Mac Millon N.
3. Lex Lauries and victor H. Rise, Floriculture Fundamentals and practices, McGrawhill publishers.
4. Mukherjee D. Gardening in India, Oxford IBH publishing co, New Delhi.
5. Randhawa, Ornamental Horticulture in India Today and Tomorrow Publishers, New Delhi.
6. Sandhu M.K., plant propogation, willey Easter Ltd., New Delhi.
7. Sundararajan, J.S., Muthuswamy J, shanmugavelu, K.G., and Balakrishnan R., A Guide to Horticulture, Thiruvenkadam Printers, Coimbatore.
8. Kumar N. Introduction to Horticulture, Raja Lakshimi Publication, Nagercoil, India.
9. Edmond Musser and Andres Fundamentals of Horticulture McGraw Hill Book Co.,
10. Amarnath V., 2006, Nursery and Lanscaping, M/s IBD Publishers, New Delhi.
- 11 Manibushari Rao K. Text Book of Horticulture, MacMillon India Ltd.

Semester - II

NME – MUSHROOM CULTIVATION

Credit : 2

Objectives:

1. To help the students to learn mushroom cultivation, bio-composting and biofertilizer production through hands- on- experience.
2. To enable the students to become self- employed/ entrepreneur.

Unit – I

Introduction, types of mushroom, identification of edible and poisonous mushroom, changes during the development of the mushroom

Unit – II

Life cycle of *Agaricus* spp., *Pleurotus* spp.,

Unit – III

Mushroom cultivation, Isolation, spawn production, growth media, spawn running and harvesting of mushroom.

Unit - IV

Medicinal and nutritional value of mushrooms, composting, importance in waste recycling

Unit - V

Diseases - insect pest, nematodes, mites, viruses, fungal competitors and other important diseases.

Post-harvest technology – freezing, drying and canning.

Suggested reading

1. Handbook of Mushroom Cultivation, 1999, TNAU publication.
2. Nita Bahl, 2002, Handbook on Mushroom 4th edition vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
3. Suman, 2005, Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.
4. Sing, 2005, Modern Mushroom Cultivation, International Book Distributors, Dehradun.
5. Mushroom growing. Dey, S.C., Agrobios (India), Jodhpur.
6. Handbook of Edible Mushroom Today and Tomorrows printers and publishers.
7. Mushroom cultivation. Kapoor, J.N., KrishiBhavan, New Delhi.
8. Mushroom Production and Processing Technology. Pathak, V.N., Yadav, N. and Gaur, M., Agrobios (India), Jodhpur.
9. Diseases and pests of Mushroom. Sharma, V.P., 2006, M/S. IBD Publishers and Distributors, New Delhi.

Semester - I

ALLIED BOTANY - I

Credit : 3

Objectives

1. To provide knowledge on the structure and reproduction of certain Cryptogams and Gymnosperms forms besides giving an overview.
2. To make the student to understand the organization of prokaryotic and eukaryotic cell, structure and function of organelles and cell division.
3. To make the student to become familiar and to understand the plant cell, tissues, and internal structures of stem, root and leaves.

Unit I

Structure and life history of *Nostoc*, *Chlorella*, *Sargassum*, *Albugo*, *Penicillium* and *Agaricus*.

Unit II

Structure and life history of *Funaria*, *Lycopodium* and *Cycas*.

Unit III

General characters of Bacteria, ultra structure of *E. coli*, Economic importance.
General account of Plant virus (TMV).

Unit IV

Prokaryotic and Eukaryotic cell (Plant Cell), Cell Organelles – structure and function of chloroplast, Mitochondria and Nucleus. Cell Division - Mitosis and Meiosis.

Unit V

Tissues : Meristematic and Permanent tissues. Primary structure of Dicot stem, dicot root and dicot leaf. Structure of monocot root.

Semester - II

Allied BOTANY - II

Credit : 3

Objectives:

1. To expose the students to the diagnostic features of selected families.
2. To provide an insight into the physico-chemical organization and the functional aspects of plants.
3. To give an insight into ecology and microbial processes in the environment.
4. To understand the lifecycle of angiospermic plant development and the various processes that are involved.
5. To know the basics in biotechnology.

Unit I

Study and range of characters of Fabaceae, Cucurbitaceae, Apocynaceae, Euphorbiaceae and Liliaceae.

Unit II

Absorption of water.

Photosynthesis – Light reaction and dark reaction (Calvin cycle), Respiration – Glycolysis, Krebs cycle & Electron transport system.

Nitrogen cycle.

Growth Hormones – Auxins, Gibberellins and Cytokinins.

Unit III

Ecosystem – definition, basic components of ecosystem, examples of ecosystem – Fresh water ecosystem, Energy flow in ecosystem – Trophic level, Food Chain, Food web.

Unit IV

Structure of Mature anther, structure of Ovule and its types.

Unit V

Plant Biotechnology – Introduction, Genetic Engineering, Tissue culture.

Semester - II

ALLIED BOTANY PRACTICAL

Credit : 4

1. Describe and to make suitable micro-preparations : Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms prescribed in the theory.
2. To describe in technical terms plants belonging to the families prescribed.
3. To describe experimental setup in plant physiology.
4. Microphotographs of cell biology
5. Study of internal structure of dicot stem, root and leaf.
6. Structure of Mature anther and Ovule types (Permanent slides only).

Suggested reading

1. Ganguly A.K. 1971, General Botany, Vol.I. The New Book Stall, Calcutta.
2. Rao. K.N. Krishnamurthy K.V. and Rao. G., 1979, Ancillary Botany, Viswanathan Private Ltd.
3. Dutta A.c., College Botany, Vol. I & II.
4. Gupta P.K., Elements of Biotechnology Rastogi and Company

B. Sc. Degree Course in
Plant Biology & Plant Biotechnology

Semester	Subject Title of the Paper	Credit	Exam. Duration Hrs.	Max. Marks		
				CIA	Ext. Marks	Total
First Semester Major Paper – I	Algology, Mycology & Lichenology	4	3	25	75	100
Allied Paper – I	Allied Botany – I	4	3	25	75	100
Second Semester Major Paper – II	General Microbiology	4	3	25	75	100
Allied Paper – II	Allied Botany – II	4	3	25	75	100
Major Practical - I Paper – III	Covering Major Paper I & II	4	3	40	60	100
Allied Practical	Covering Allied papers I & II	4	3	40	60	100
Third Semester Major Paper – VI	Bryophytes & Pteridophytes	4	3	25	75	100
	Gymnosperm,	4	3	25	75	100

Fourth Semester Major Paper – V	Paleobotany & Evolution					
Major Practical - II Paper – VI	Covering Major Paper III & IV	4	3	40	60	100

Semester	Subject Title of the Paper	Credit	Exam. Duration Hrs.	Max. Marks		
				CIA	Ext. Marks	Total
Fifth Semester Paper – VII	Cell Biology & Anatomy	4	3	25	75	100
Paper - VIII	Taxonomy and Embryology of Angiosperm	4	3	25	75	100
Paper – IX	Plant Biotechnology	4	3	25	75	100
Paper - X	Plant Physiology & Biochemistry	4	3	25	75	100
Elective – I	Plant Diseases & Management	4	3	25	75	100
Sixth Semester Paper – XI	Genetics & Plant Breeding	4	3	25	75	100
Paper - XII	Environmental Science & Phytogeography	4	3	25	75	100
Paper – XIII	Microtechnique	4	3	25	75	100
Elective II :	Herbal Science	4	3	25	75	100
Elective – III :	Horticulture	4	3	25	75	100
Major Practical – III Paper – XIV	Covering Papers in V Semester (Papers VII, VIII, IX & X)	4	3	40	60	100
Major Practical – IV Paper – XV	Covering Papers in VI Semester (Papers XI, XII & XIII)	4	3	40	60	100

Odd Semester

Semester – I Paper – I : Phycology

Unit – I

Classification of algae - F.E. Fritsch, 1945.

Unit – II

General Characters of selected algal groups (Cyanophyceae, Chlorophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae).

Unit – III

Cyanophyceae, Chlorophyceae, Bacillariophyceae (no developmental studies)

Cyanophyceae – *Nostoc*, *Anabaena*

Chlorophyceae – *Chlorella* (Unicellular), *Scenedesmus* (Colonial), *Coleochaete* (Heterotrichous) and *Caulerpa* (Thalloid).

Bacillariophyceae – Diatoms – *Navicula*.

Unit – IV

Detailed study of distribution, habit, pigmentation, plastids, food reserves, reproduction and life cycles of the following forms of Phaeophyceae and Rhodophyceae (no developmental studies).

Phaeophyceae – *Sargassum*

Rhodophyceae – *Gracilaria*.

Unit – V

Economic Importance of Algae – Algae as food (SCP), fodder, biofertilizers, oxidation ponds and medicines. Industrial uses of algae (Alginates, Agar and diatomaceous earth).

Practical:

A detailed study of genera included in the theory.

Non Major Elective – Nursery and Landscaping

Unit – I

Introduction , Prospects and scope of nursery and landscaping.

Unit – II

Methods of propagation – cutting, layering, grafting, budding, floriculture – *Rose*, *Chrysanthemum*, *Jasmine* – cultivation.

Unit – III

Gardening – formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn.

Unit – IV

Nursery structures – Green house, shade house, mist chamber – topiary, bonsai culture.

Unit – V

Manures, composting – vermicomposting.

Allied BOTANY - Paper I

Unit – I : Cell Biology

Prokaryotic and Eukaryotic cell (Animal & Plant Cell), Cell Organelles – structure and function of chloroplast, Mitochondria and Nucleus. Cell Division - Mitosis and Meiosis.

Unit – II : Anatomy

Tissues : Meristematic and Permanent tissues. Primary structure of Dicot stem, dicot root structure of dicot leaf, structure of monocot root. Normal secondary thickening of dicot stem.

Unit – III : Bacteria and Viruses

General characters of Bacteria – shape, flagellation, grams staining, structure of *E. coli*, reproduction (vegetative and asexual), Economic importance. Viruses – General characteristics – generalized structure of viruses - structure of Tobacco Mosaic virus (TMV), structure of bacteriophage – its multiplication.

Unit – IV :

Structure and life history of (a) *Nostoc*, *Chlorella*, *Sargassum* and *Gracilaria*.

(b) *Albugo*, *Yeast*, *Penicillium* and *Agaricus*

Unit V

Structure and life history of (a) *Funaria*, (b) *Lycopodium* and (c) *Cycas*.

Economic Importance of *Nostoc*, *Chlorella*, *Saccharomyces*, *Penicillium* and *Agaricus*.

UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN BOTANY
SEMESTER SYSTEM WITH CREDITS
(Effective from the Academic Year 2003-2004)

SYLLABUS

SYLLABUS FOR ALLIED BOTANY

PAPER II

Unit - I: Taxonomy

General outline of Bentham and Hookers system of classification Study of the range of characters and plants of economic importance in the following families: Annonaceae, Fabaceae, Rubiaceae, Apocynaceae, Euphorbiaceae and Liliaceae.

Unit - II: Embryology

Structure of mature anther. Structure of mature ovule its types. Structure of pollen grain. Development of male gametophyte. Fertilization.

Unit - III: Plant Physiology

Absorption of water Physiological role of micro and macro elements - their deficiency symptoms Photosynthesis -- light reaction - Calvin cycle Respiration -. Glycolysis Krebs' cycle - electron transport system. Nitrogen cycle. Growth hormones - auxins gibberellins and cytokinins - their applications -Tissue culture - its significance

Unit - IV: Ecology

Ecosystem -- definition - basic components of ecosystem examples of ecosystem fresh water ecosystem. Energy flow in ecosystem trophic level. Food chain - food web. Environmental pollution. Major pollutants types of pollution air pollution. water pollution, soil pollution - control measures.

Unit - V : Genetics

Mendelism - monohybrid and dihybrid crosses - inbreeding and outbreeding.

Practical (2 hrs)

1. To describe in technical terms, plants belonging to any of the families prescribed and to identify the family
2. To dissect a flower,, construct floral diagram and write floral formula
3. To make suitable micropreparations. describe and identify materials of Algae, Fungi, Bryophyte, Pteridophyte, Gymnosperm and Angiosperm. prescribed
4. To describe simple experimental setup in plant physiology section of the syllabus

Books Suggested

1. General botany - Vol I & II, Ganguly A.K and Kurnar N .C, Emkay Publications, Delhi
2. Systematic Botany, Dutta S.C. Wiley Eastern Limited, New Delhi
3. Introductory Botany, Ashok Bendre and Pande, P.C Rastogi Publications, Meerut
4. Concepts of Cell Biology, Verma P.S and Agarwal V.K, S .Chand & Co, Rain Nagar, New Delhi
5. Elements of Ecology, Sharma P.D, Rastogi Publications, Meerut
6. Ancillary Botany, Rao K.N. Krishnamoorthy K.V, Rao G. S.Viswanathan pvt Ltd, Madras
7. Basic Biotechnology, Rev.Fr.Dr.Ignacirnuthu, S.J. Tata McGraw hill Publicaiton Co. new Delhi