THIRUVALLUVAR UNIVERSITY
MASTER OF SCIENCE
M.Sc. Botany
DEGREE COURSE
UNDER CBCS
(With effect from 2017-2018)

The course of Study and Scheme of Examinations:

Semester	Paper Code	Paper	Title of the Paper	Ins Hrs/ week	Credits	CIA	Exam	Total Marks
I Semester	PBO11	Paper-1	Phycology and Bryology	6	5	25	75	100
	PBO12	Paper-2	Mycology, Bacteriology, Lichenology and Plant Pathology	6	5	25	75	100
	PBO13	Paper-3	Pteridophytes, Gymnosperms and Palaeobotany	5	5	25	75	100
	PBO14A PBO14B PBO14C	Elective Paper -1	Seed technology (or) Microbiology (or) Pharmacognosy	3	3	25	75	100
	PBO25	Practical	Practical-I, covering Papers I, II & III	5	-	-	-	-
	PBO26	Practical	Practical-II, covering Papers IV, V & VI	5	-	-	-	-
				30	**18**	**100**	**300**	**400**
II Semester	PBO21	Paper-4	Anatomy and Embryology of Angiosperms	5	4	25	75	100
	PBO22	Paper-5	Cell and Molecular biology	5	3	25	75	100
	PBO23	Paper-6	Genetics and Plant breeding	5	4	25	75	100
	PBO24A PBO24B PBO24C	Elective Paper-2	Herbal Botany (or) Techniques in Botany (or) Industrial Microbiology	3	3	25	75	100
	PHR20		Human Rights	2	2	25	75	100
	PBO25		Practical-I, covering Papers I, II & III	5	5	25	75	100
	PBO26		Practical-II, covering Papers IV, V & VI	5	5	25	75	100
				30	**26**	**205**	**495**	**700**

Year/ Semester	Subject	Paper	Title of the Paper	Ins Hrs/ week	Credits	CIA	Univ Exam	Total Marks
III Semester	PBO31	Paper-7	Taxonomy of Angiosperms Biodiversity and Economic Botany	6	5	25	75	100
	PBO32	Paper-8	Biotechnology and Genetic Engineering	6	5	25	75	100
	PBO33	Paper-9	Ecology and Toxicology	5	5	25	75	100
	PBO34A PBO34B PBO34C	Paper -3	Plant Tissue culture (or) Forestry, Plant geography and Biodiversity (or) Horticulture and Landscaping	3	3	25	75	100
	PBO45	Practical III	Practical-III, covering Papers VII, VIII & IX	5	-	-	-	-
	PBO46	Practical IV	Practical-IV, covering Papers X, XI & XII	5	-	-	-	-
				30	**18**	**100**	**300**	**400**
IV Semester	PBO41	Paper-10	Plant Physiology	6	5	25	75	100
	PBO42	Paper-11	Plant Biochemistry and Biophysics	6	5	25	75	100
	PBO43	Paper-12	Research Methodology	5	5	25	75	100
	PBO44A PBO44B PBO44C	Elective Paper-4	Bioinformatics (or) Wood Technology (or) Biodiversity and Conservation Biology	3	3	25	75	100
	PBO45	Practical III	Practical-III, covering Papers VII, VIII & IX	5	5	25	75	100
	PBO46	Practical IV	Practical-IV, covering Papers X, XI & XII	5	5	25	75	100
				30	**28**	**180**	**420**	**600**

Subject	Papers	Credit	Total Credits	Marks	Total marks
MAIN	12	4-5	58	100	1200
MAIN PRACTICAL	4	4-5	18	400	400
ELECTIVE	4	3	12	100	400
COMPULSORY PAPER	1	2	2	100	100
Total	**21**	**-**	**90**	**-**	**2100**

THIRUVALLUVAR UNIVERSITY
MASTER OF SCIENCE - M.Sc. BOTANY
DEGREE COURSE
SYLLABUS
UNDER CBCS
(With effect from the Academic year 2017-2018)

I – SEMESTER

PAPER – 1

PHYCOLOGY AND BRYOLOGY

PHYCOLOGY:

Unit – I Classification and evolution of Algae

Criteria used in the classification of algae (Bold and Wynne,1978). Phylogeny and interrelationships among algae. Origin and evolution of sex in algae. Account of fossil algae. Distribution of algae. Pigmentation of algae. Flagellation of Algae. Life cycles of algae.

Unit – II Diversity of Algae

Structure, reproduction, life history and evolutionary trends in Chlorophyta, Phaeophyta, Rhodophyta and Cyanophyta with detailed study of forms
Chlorophyta : *Desmids, Ulva, Caulerpa, Halimeda* and *Nitella.*
Bacillariophyta: Navicula and Cyclotella
Phaeophyta *: Dictyota and Padina*
Rhodophyta : *Polysiphonia and Gracilaria* .
Cyanophyta : *Anabaena* and *Spirulina.*

Unit – III Economic importance of algae

Algae as source of medicine, food, animal feed, hydrocarbon and biofertilizers. Algae as pollution indicators-role of algae in bioremediation. Role of Algae in soil fertility. Freshwater and marine algal cultivation techniques.

BRYOLOGY :

Unit IV Classification and evolution of Bryophytes

Bryophytes as Amphibians of the kingdom Plantae, Different theories, Life cycle, Gametophyte, reproduction, sporophyte, alteration of generations, salient features of Bryophytes, resemblances and differences of bryophytes with algae and pteridophytes. Watson Classification. A brief account of the development of bryology in India. Ecology and distribution of bryophytes. Fossil forms of bryophytes. Economic importance of bryophytes.

Unit V Diversity of Bryophytes

Range of variation in structure and evolution of gametophytes, sex organs, sexual and asexual reproductions and sporophytes in Bryophytes mentioned below: Marcanti*a, Targionia, Lunularia, Reboulia, Pellia, Porella, Anthoceros* and *Sphagnum.*

Practicals

Field trips to be conducted for students to get familiarized with the local flora of algae and bryophytes.

External morphology and internal structure of vegetative and reproductive parts of the following Genera**:**

Algae : *Desmids, Ulva, Caulerpa, Halimeda, Nitella,* Navicula, Cyclotella, *Dictyota, Padina, Polysiphonia, Gracilaria, Anabaena and Spirulina.*

Bryophytes : Marcanti*a, Targionia, Lunularia, Reboulia, Pellia, Porella, Anthoceros and Sphagnum.*

Books:

1. Bilgrami, K.S. and L.C. Saha, 2004. A textbook of Algae, CBS publications
2. Chandrakant Pathak, 2003. The latest portfolio of theory & practice in Bryophyta, Dominant publications.
3. Chopra, R.N. and P.K. Kumar, 2003. Biology of Bryophytes, New age International Pvt.
4. Fritsch, F.E., 1972. Structure and reproduction of Algae VoI. I and II. Cambridge Univ. Press.
5. Graham,L.E.,1993. Origin of land Plants. John Wiley & Sons, New York.
6. Lembi, Carole, A. and J.Robert Waland.1988. Algae and human affairs. Cambridge University press.
7. Pandey, S.N., S.P.Misra and P.S. Trivedi. 2002. A Textbook of Botany Volume II. Vikas Publishing House Pvt Ltd, New Delhi.
8. Parihar, N.S.,1985. An introduction to Embryophyta – Bryophytes. Central Book Depot. Alahabad.
9. Prempuri, 1986. Bryophytes-Morphology, growth and differentiation. Atma Ram & sons, New Delhi.
10. Rashi, A., 2007. An Introduction to Bryophyta – Vikas publications, New Delhi.
11. Sambamurthy, A.V. S.S., 2005. A Textbook of Algae. I.K. International Pvt.Ltd, New Delhi.
12. Sharma, O.P., 2006. A Textbook of Algae, McGraw Hill Publishing Company, New Delhi.
13. Smith, 1951. The manual of phycology. Mc Graw Hill Book Co.
14. Smith, A.J.E., 1982. Bryophyte Ecology. Chapmanand Hall, Lodon.
15. South, G.R. and Whittik, A., 1987.Introduction to Phycology. Blackwell Scientific Publications, Oxford.
16. Vashishta. B.R., Sinha, A.K. and Adarsh Kumar, 2005. Botany for Degree students-Bryophyta. S. Chand and Company Ltd., New Delhi.
17. Vashishta. B.R., Sinha, A.K. and Adarsh Kumar. 2008. Botany for Degree students - Algae. S. Chand and Company Ltd., New Delhi.
18. Watson, E.V., 1971. The structure and Life of Bryophytes. Hutchinson & co Ltd, London.

PAPER - 2

MYCOLOGY, LICHENOLOGY, BACTERIOLOGY AND PLANT PATHOLOGY

MYCOLOGY

Unit – I Classification and diversity of Fungi (Lower groups)

Introduction to Fungi. Recent trends in the classification of Fungi with special reference to Alexopoulos and Mims (1979). Structure, Nutrition, reproduction, life history, phylogeny and affinities of the major groups of Fungi.
Myxomycotina : *Stemonites.*
Eumycotina : *Synchytrium,*
Mastigomycotina : *Peronospora*
Plasmodiophoromycetes : *Plasmodiophora.*
Zygomycotina : *Pilobolus.*

Unit –II Diversity of Fungi (Higher groups) and Lichens

Ascomycotina : *Aspergillus, Erysiphe, Claviceps, Peziza.*
Basidiomycotina *: Polyporus, Puccinia*
Deuteromycotina : *Alternaria, Fusarium*
Role of fungi in Industry, Medicine and as food.
Lichen: classification, structure, nutrition, reproduction and economic importance of Lichens.

Unit – III BACTERIOLOGY

Classification of Bacteria according to Bergey's manual- Ultra structure, types and reproduction of Bacteria. Bacterial transformation, transduction and conjugation. Microbial staining methods- stains and dyes- Gram, flagellar and other types of staining – Estimation of microorganisms in soil, air and water.

PLANT PATHOLOGY

Unit – IV General Topics

History of Plant Pathology – Koch's Postulates – Classification of Plant Diseases – Host parasite interaction – Metabolic changes during disease development – Role of enzymes and toxins during pathogenesis - Etiology, Principles and methods of disease control – Chemical, Biological and Agronomical Practices- Legislation and Quarantine measures. Verification of Koch's postulates

Unit - V Plant diseases

General account on algae, fungi, bacteria, virus, mycoplasma and nematode plant pathogens. Host microbe interactions. Study of the following disease dissemination and its control measures - Blast of Paddy; Blight of rice; Red rot of Sugar cane; Tikka disease of ground nut; Damping off of seedlings; Leaf spot of Turmeric, Leaf spot in Cotton ; Blight of Paddy ; Citrus canker ; Tobacco Mosaic and Little leaf of Brinjal. Principles of disease control-physical, chemical and biological methods.

Practical:

Mycology

Structure, reproduction and diagnostic features of *Stemonites, Synchytrium, Peronospora, Pilobolus, Aspergillus, Erysiphe, Claviceps. Peziza, Puccinia, Polyporus, Alternaria, Fusarium, Parmelia,* Usnea and *Cladonia.*

Bacteriology and Plant Pathology:

Identification of Bacterial, fungal and Viral plant diseases included in theory syllabus. Gram staining techniques of Bacteria.

Books:

1. Alexopoulos, C.J., Mims, C.W. and M. Blackwell. 2007. Introductory Mycology. IV Edition. Wiley India (P) Ltd., Daryaganj, New Delhi.
2. Ainsworth, G.C., Sparrow, F.K. and Sussman, A.S., 1973. The Fungi, Academic Press.
3. Bessay, E.A., 1979. Morphology and Taxomony of Fungi. Vikas publishing House, New Delhi.
4. Bilgrami, K.S. and H.C. Dube,1990. A text book of Plant Pathology. Vikas publishing house Pvt. Ltd, New Delhi.
5. Burnett, J.H.,1976. Fundamentals of Mycology. Edward Arnold Press.
6. George, N. Agrios, 2006. Plant Pathology – 5th edition, Elsevier.
7. Hale, M.E., 1983. Biology of Lichens. Arnold. London.
8. Mehrotra, R.S. and Ashok Aggarwal, 2004. Plant pathology – 2nd Edition, Tata Mc Graw – Hill.
9. Michael,J Pelczer, E.C.S. Chan , NoelR. Krieg, 1993.Microbiology—concepts and applications, McGraw Hill Inc, New York.
10. Moore Landecker,E., 1971. Fundamentals of Fungi. Prentice Hall Publication.
11. Mukta Bhargava, 2003. The latest portfolio of theory and practice in Fungi, A.S Saini Dominant publications.
12. Prescott, John, Harley, P., Donald, Klein, A., 1995. Microbiology(2nd Edition), WMC Brown brothers.
13. Rangaswami, G., 1988. Disease of crop plants in India. Prentice Hall Pvt.Ltd. New Delhi.
14. Rangaswami, G and A.Mahadevan 1998. Disease of crop plants in India. (4th Edition) Prentice Hall Pvt.Ltd. New Delhi.
15. Sambamurthy A.V. S.S., 2006. A Textbook of Plant Pathology. I.K. International Pvt.Ltd., New Delhi.
16. Singh, R.S. 2005. Principles of Plant Pathology – 4th edition. Oxford & IBH.
17. Vashista, B.R and Sinha, A.K., 2008. Botany for Degree Students – Fungi. S.Chand & Company, New Delhi.
18. Wolf and Wolf, 1947. The Fungi Vol. I & II. John Wiley & Sons, New York.

PAPER - 3

PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY

PERIDOPHYTES
Unit – I General Topics

General characters - Reimer's classification of Pteridophytes.
Origin of Pteridophytes - Different theories – Life cycles, Telome concept.
Sporangium development – a) Eusporangiate type b) Leptosporangiate type c) Intermediate type.
Range of structure, reproduction and evolution of the gametophytes, Gametophyte types – sex organs. Apogamy and Apospory.
Stelar evolution- Protostele – types, Siphonostele, Solenostele and Dictyostele.
Detailed account of Soral evolution – soral types, soral characters and phylogeny of ferns.
Heterospory and seed habit.

Unit – II Diversity in Pteridophytes

Range of structure, evolution of sporophytes in Pteridophytes of the forms - *Psilotum, Isoetes, Ophioglossum, Angiopteris, Osmunda, Dichranopteris, Alsophila* and *Salvinia.*

GYMNOSPERMS
Unit – III Diversity in Gymnosperms

Classification of Gymnosperms (Sporne,1965). Economic importance of Gymnosperms.
A general account of distribution of gymnosperms. Morphology, anatomy, reproduction, phylogeny and relationship of the following orders with special reference to the genera mentioned against each order.

Cycadopsida : *Cycas, Zamia*
Coniferopsida: *Cupressus ; Podocarpus ; Araucaria*
Gnetopsida : *Gnetum ; Ephedra*

PALAEOBOTANY
UNIT – IV General topics

Gondwana flora of India. Contribution of Birbal Sahni to Paleaobotany. Study of fossils in undersatanding evolution. Fossilization and fossil types. Economic importance of fossils – fossil fuels and industrial raw materials.

UNIT – V

Fossil forms
Detailed study of the following fossil forms -
Pteridohytes : *Rhynia, Lepidodendron, Lepidocarpon, Sphenophyllum* and *Calamites.*
Gymnosperms : *Lyginopteris, Heterangium, Laginostoma, Cordaites* and *Welweltschia.*

Practicals :

1. Field trips to be conducted for students to get familiarized with the local flora of pteridophytes and gymnosperms.

2. External morphology and internal structure of vegetative and reproductive parts of the following Genera**:**

PERIDOPHYTES: *Psilotum, Isoetes, Ophioglossum, Angiopteris, Osmunda, Dichranopteris, Alsophila* and *Salvinia.*

Fossil forms : *Rhynia, Lepidodendron, Lepidocarpon, Sphenophyllum* and *Calamites.*

Gymnosperms: Cycas, *Zamia, Cupressus, Podocarpus, Araucaria* and *Ephedra.*
Fossil forms: *Lyginopteris, Heterangium, Lagenostoma, Cordaites* and *Welweltschia.*

Books

1. Banks, H.P,1970. Evolution and Plants of the past. Wadsworth publishing Co, Belmont.
2. Beck,C.B, 1988. Origin and evolution of Gymnosperms. Columbia University press, New Delhi.
3. Bhatnagar, S.P. and Alok Moitre,2003. Gymnosperms, New Age International, New Delhi.
4. Bierhorst, D.W, 1971. Morphology of vascular Plants. Macmillan publishing Co, New York.
5. Biswas,c., B.M.Johri, 1999. The Gymnosperms, Narosa Publishing House, Chennai.
6. Delevoryas, T., 1962. Morphology and evolution of fossil plants. Holt Rinehart and Winston, New York.
7. Gensel, P.G and Andrews, H.N., 1984. Plant life in the Devonian. Preger publications, New York.
8. Gifford, E.M and Foster, E.S., 1984. Morphology and evolution of vascular plants. 3rd edition, W.E. Freeman and Co, New York.
9. Graham, L.E., 1993. Origin of land plants. John Wiley & Sons, New York.
10. Mukta Bhargava, 2003. The latest portfolio of theory and practice of Gymnosperms. Dominant Publishers and Distributors, New Delhi.
11. Parihar, N.S., 2005. An introduction to Embryophyta– Pteridophytes – Central Book Depot, Allahabad.
12. Pandey, S.N., S.P.Misra and P.S. Trivedi. 2002. A Textbook of Botany Volume II. Vikas Publishing House Pvt Ltd, New Delhi.
13. Rashid.A. 2007. An Introduction to Pteridophyta – Vikas publications, New Delhi.
14. Sporne, K.R. 1962. The morphology of Pteridophytes. Hutchinson Univ. Library, London.
15. Sporne, K.R. 1965. The morphology of Gymnosperms. Hutchinson Univ. Library, London.
16. Vashishta. P.C., A.K. Sinha and Adarsh Kumar. 2008. Botany for Degree students - Pteritophyta. S. Chand and Company Ltd., New Delhi.
17. Vashishta. P.C., A.K. Sinha and Anil Kumar. 2007. Botany for Degree students - Gymnosperms. S. Chand and Company Ltd., New Delhi.

ELECTIVE

PAPER – 1
(Choose either A or B or C)

A. SEED TECHNOLOGY

Unit –I Type of seeds

Classification of seeds, Recalcitrant seeds, Dicot and monocot seeds—Morphology and types, Seed reserves. External and internal structures of seed - their functional significance, Albuminous and Ex-Albuminous seeds.

Unit –II Seed dormancy

Types of dormancy—physical, Physiological, Morphological, Chemical and mechanical, Primary and secondary dormancy, Photo and Skoto dormancy. Methods to overcome dormancy. Ecological significance of seed dormancy.

Unit – III Seed Germination

Seed maturation and germination – metabolism during germination. Epigeal and Hypogeal germination, Germination mechanism. Brief account of Germination value, Germination rate, Germination percentage. Germination ecology: Environmental factors and germination behaviour.

Unit –IV Seed Viability

Seed production in self and cross pollinated plants, Classes of seeds- traditional, breeder, foundation and certified seeds. Viabilty tests- their significance and importance. Seed harvesting, processing, treatments, testing and seed sampling, viability and vigour. Critical role of seed moisture content and environmental factors on viability. Viability period of Indian forestry Species.

Unit V Seed Storage

Effect of storage on seed longevity, Seed germplasm and storage in different conditions. Cryopreservation, Static conservation of seeds. Seed borne pathogens and pests—seed treatments. Seed certification, Standard inspection, registration and seed law enforcement. Clonal seed orchards, seed banks.

Books

1. Agarwal, R.L. 1997. Seed Technology, Scientific Publishers, Jodhpur.
2. Agarwal. P.K. and M. Dadlani, 1992. Techniques in seed science and technology, Scientific
3. Publisher, Jodhpur.
4. Khan, A.A. 1977. Physiology and Biochemistry of Seed dormancy and germination,
5. Oxford & IBH Publishing company (P) Ltd, New Delhi.
6. Online resources available at internet site.

ELECTIVE

PAPER – 1

(Choose either A or B or C)

B. MICROBIOLOGY

MICROBIOLOGY

Unit –I Microbial Taxonomy

Brief outline of microbial diversity-Microbial taxonomy, Microbial flora of soil. General feature and classification of of microorganism like Ricketsias—Mycoplasma—Archaebacteria – Actinomycetes – Protozoa. Brief outline of methods in microbiology for isolation and culture of microorganisms from environment and infected plants, Culture media characterization and preparation – staining of microbes. Estimation of micro organisms in soil, water and air.

Unit – II Bacterial Structure

Nutrition and growth curve of Bacteria – measurement of growth. Methods of culturing bacteria - sterilization- kinds of media and preparation techniques- - pure culture- maintenance and preservation. Bacterial staining methods: simple staining, Gram's staining, acid fast staining, staining of flagella and other types of staining.

Unit – III Viruses

Morphology of Viruses- Classification of Viruses – transmission of viruses- Virus-Vector relationships- replication of Virus. General account on Mycoplasma and Spiroplasma- Satellite virus. Bacteriophages- Viroids and Prions- Isolation and purification of viruses. Uses of virus in Biotechnology.

Unit – IV Environmental microbiology

Microbial flora of soil – influence of environmental factors like pH, light, organic matter, moisture and temperature. Role of microbes in cycling of nitrogen, carbon and phosphorus. Microbial control—methods of physical control (heat, cold, desiccation, radiation and sound waves). Microbial leaching of minerals. Sterilization by filtration, chemical agents—disinfectants, antiseptics and antibiotics.

Unit –V Industrial microbiology

Role of microbes in waste water treatment, General design and application of biofermentor. Microbes in food spoilage and food poisoning. Food preservation – Micro organisms as food—Probiotics. Genetically modified food. Industrial products of micro organisms. Microbes used as biofertilizers -*Rhizobium, Azospirillum, Acetobacter, Azolla* and blue-green algae. Application of fungal enzymes in different industries—immobilization of enzymes – biofuel, ethanol, biogas and biodiesel production.

Books

1. Ananthanarayanan, R. and CKJ. Paniker, 2004. Textbook of Microbiology. Orient Longman Pvt. Ltd.,
2. Arora, D.R., 2004. Text book of Microbiology, CBS.
3. Dubey, R.C. and D.K. Maheswari, 2007. A Textbook of Microbiology, S. Chand & Company, New Delhi
4. Michael, J. Pelczar, JR. E.C. Channoel, R.Krieg, 2005. Microbiology, Mc. Graw-Hill.
5. Powar, C.B and Daginawala 1991.General Microbiology Vol-I and Vol-II Himalaya publishing house, Bombay.
6. Sullia, S.B and S. Shantharam, 2005. General Microbiology, Oxford & IBH
7. Vasanthkumari.R.2007. A Textbook of Microbiology. BI Publications Pvt. Ltd.

ELECTIVE
Paper - 1
(Choose either A or B or C)
C. PHARMACOGNOSY

UNIT-1: Introduction

Definition. History and scope of Pharma cognosy. Indigenous system of medicine: Ayurveda, Homeopathy, Unani, tradiditonal Chinese Medicine, Naturopathy, Yoga and Siddha. Classification of drug of natural origin. Adultration and drug evaluation. Significance of Pharmacopoeial standards.

UNIT – 2 : Plant constituents

Occurrence, distribution, classification, isolation, idendification test and pharmaceutical applications : plant metabolites, carbohydrate lipids, protein and amino acids, nucleic acids, glycosides, terpenoids, volatile oil / essential oil / ethernal oil, resin and tannins.

UNIT – 3 Therapeutic Uses of Plant, Drugs

Occurrence, distribution, organoleptic evaluation, chemical constituents including tests wherever applicable and therapeutic efficacy of following categories of drugs. (a) Laxatives: Aloes. Rhuburb. Castor Oil. Ispaghula. (b)Cardiotonics- Digitalis Arjuna. (c) Carminatives and G.I. regulators. Umbelliferous fruits, Coriander, Cardamom, Ginger, Black pepper, Asafoetida, Nutmeg and Clove. (d) Astringents: Catechu (e) Drugs acting on nervous systems - belladonna, Aconite, Ashvagandha, Ephedra and Opium.(f) Anti diabetics- pterocarpus, Gymnema sylvestre.

UNIT – 4 : Industrial uses of Medicinal Plants:

Perfumes and flavouring agents- peppermint oil, Lemon oil, Orange oil, Lemon grass oil and Sandal wood.
Pharmaceutical aids- honey. Arachis oil, Starch, Kaolin, Pectin, Olive oil, Lanolin, Bees wax, Acacia, Tragacanth, Sodium alginate, Agar, Guargum and Gelatin.
Miscellaneous- liquorice, Garlic, Picrorhiza, Dioscorea, Linseed, Shatavari, Shankhapushpi, Pyrethrum and Tobacco.

UNIT – 5 Crude Plant Drugs

Collection and preparation of crude drug for the market as exemplified by ergot, opium, Rauwolfia, Digitalis and senna.
Gross anatomical studies of senna, Datura, Cinnamon, Cinchona, Fennel, Clove, Ginger, Nuxvomica and ipecacuanha.

BOOKS

1. Doby G.plant Biochemistry Inter Science Publishers, New York..
2. Dey. P.M. and J.B.Horborne: Plant Bio Chemistry Acadamic Press, London.
3. Sadasivam. S. and A. Manickam : Bio Chemical methods 2nd edition. New age, International Pvt. Ltd. New delhi.
4. Horborne. J.B. 1983. Phyto chemical methods. Chapman and Hall. London.
5. Trease. G.E. and Evanes W.C.Pharmacognosy. 12th eddition Bailliere, Tindall, East Bourne, U.K. 1983.
6. Kokate. C.K.Purohit A.P. and S.B. Gokhale. Pharmacognosy Nivali Prakashan Publication.
7. Miller.L.P. Phyto chemistry. 1-3 volumes Van Nostrand, Reinhold Co. 1973.
8. Pharmacopoeia of India. Govt. of India. Ministry of health 1955 and 1966.
9. Sayeed Ahmad - Introduction of Pharmacognosy

SEMESTER II

PAPER – 4

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

ANATOMY OF ANGIOSPERMS

Unit – I Tissue system

Xylem and Phloem and their elements – Primary and Secondary structures , differentiation– patterns of secondary walls—structural variation and characteristics of phloem component.– Phylogenetic trends and specialization of xylem and phloem.
Periderm - Structure and development – protective tissue in monocots- Wound healing and grafting, tyloses and Lenticels. Growth rings—heart and sap wood, porous and non-porous wood.

Unit – II Meristems

Meristem and Differentiation - Classification of Meristems - Growth Patterns – Apical Meristem- Theories of Apical Meristem - organization - Promeristem
Shoot Apex and Root Apex.
Vascular Cambium - Origin, Structure, and types. Cambial activity Normal and anomalous -- (Anomalous secondary thickening in dicots and monocots).

Unit –III Wood and Leaf anatomy

Nodal anatomy – uni, tri and multilacunar nodes and their phylogenetic relationships
Secretory structures – external and internal.
Leaf anatomy – Types of stomata , Ontogeny and histogenesis of bifacial and unifacial leaf-kranz anatomy.
Wood anatomy : Physical , Chemical and Mechanical properties of wood –
defects in wood - Natural defects – knots – defects due to foreign organisms, defects due to external stress - Reaction wood: Tension wood and compression wood. Durability of wood.

EMBRYOLOGY

Unit - IV Sporogenesis and Fertilization

Microsporogenesis : Morphology , cytology, development and formation of microspores and male gametes – role of tapetum vegetative and generative nuclei – pollen wall morphogenesis. Pollen sterility and fertility and role of palynology.
Megasporogenesis : Types and structure of ovules. Megasporogenesis – Special structures of ovules. Organisation of the embryo sac, types of embryo sac, role of synergids and antipodal haustoria, nutrition of embryo sac.

Unit - V Endosperm and Embryo Development

Pollen – pistil interactions and fertilization : barriers of fertilization, control of fertilization and current concept of fertilization heterospermy, polyspermy and heterofertilization.
Endosperm : classification and endosperm types, Endosperm haustoria –
Embryogeny – laws of embryogeny - development of dicot and monocot embryo –nutrition of embryo.
Polyembryony : classification and types.
Apomixis: diplospory , apospory, parthenogenesis and parthenocarpy.

Practical:
Angiosperm Anatomy:

1. Examination of Root and Shoot apices.
2. Maceration, clearing and peeling techniques.
3. Cambial variant in *Bougainvillaea, Boerhaavia, Nyctanthes, Bignonia, Aristolochia, Strychnos* and *Dracaena*.
4. Nodal Anatomy – Different types of nodes.
5. Different types of stomata.
6. Calculation of stomatal index and frequency.

Embryology

1. Slides showing stages of anther, embryo sac, endosperm and embryo development.
2. Types of ovules.
3. Pollen germination and viability test.
4. Dissection of embryo – *Tridax, Crotalaria and Cleome.*
5. Endosperm and endosperm haustoria – Cucurbitaceae members.

Books

1. Bhojwani, S.S. and Bhatnagar, S.P. 1981. Embryology of angiosperms. Vikas Publication Pvt.Ltd. New Delhi.
2. Eames, A.J and Mac Daniel, 1975. An introduction to Plant Anatomy. TMH edition, Tata MacGraw Hill, New Delhi.
3. Esau, K. 1972. Plant anatomy. John Wiely & Sons, Newyork.
4. Esau, K. 1989. Anatomy of seed plants. John Wiely & Sons, Newyork
5. Maheshwari, P. 1963. An Introduction to embryology of Angiosperms. Tata Mc Grow Hill. Newyork.
6. Pandey, P.B. 2000. Plant Anatomy. S.Chand & Co.,
7. Pandey.S.N. and Ajanta Chandha. 2006. Plant Anatomy and Embryology. Vikas Publishinf House Pvt.Ltd , New Delhi.
8. Shivanna.K.R. 2003. Pollen biology and biotechnology. Oxford IBH, New Delhi
9. Singh.V., P.C. Pandey and D.K.Jain. 2003. Embryology of Angiosperms. Rastogi Publications. Meerut.

PAPER – 5

CELL AND MOLECULAR BIOLOGY

CELL BIOLOGY

UNIT – I Cell and Cell organelles:

General account of Prokaryotic and Eukaryotic Cell, Cell wall, plasmamembrane. Ultrastrucure, Chemistry and Functions of mitochondria, Dictyosomes, lysosomes, endoplasmic reticulum, ribosomes, peroxisomes, Glyoxysomes plasmids, vacuoles, chloroplast, Nucleus – history, Ultrastrucure, chemistry and functions, nucleo cytoplasmic ratio, role of nucleus in cell cycle. Structure and functions of Nucleolus—importance of nucleolus in cell division.

UNIT – II Chromosomes

Chromosomes: Types, Fine structure of eukaryotic chromosome, chemistry – Kinetochore, chromomeres, statellite, Euchromatin and Heterochromatin- special types of chromosomes – lamp brush chromosome, polytene chromosome, B- Chromosomes.
Architectural changes of chromosomes: detailed study of chromosomal deficiency, duplication, inversion and translocation and their role in evolution. Karyotype analysis – Importance of Cytotaxonomy.

Unit III Cell Division

The Cell cycle : cell reproduction, events of the eukaryotic cell cycle, variations in cell-cycle organization, cell cycle control system. Model organisms in cell-cycle analysis. Cell cycle control system. Chromosome duplication. Mitosis, cytokinesis and Meiosis. Mitotic inducers and inhibitors, variations in mitosis and meiosis.

UNIT – IV Gene

Genes and chromosome: types of DNA, proteomics, genes codes for protein, content of the genome, genome evolution, chromosome and chromatin. DNA replication and Recombination: the replicon, extrachromosomal replicons, bacterial replicon is connected to the cell cycle, DNA replication, homology and site specific recombination, repair systems, transposable elements and retrovirus, somatic recombination and hypermutation in the immune system.

UNIT - V Transcription and Gene Regulation

Transcription, RNA splicing and processing, mRNA stability and localization, catalytic RNA, Translation, using genetic code, trancription: Introduction, RNA polymerase – structure and sub-units. Reverse transcriptions, Translation—Outline of translation, Overlapping of genes. mRNA, tRNA and rRNA, capping and polyadenylation. Gene Regulation – Operon concept.

Practical:

Cell Biology

1. Study of cell division – Mitosis (*Allium cepa, Rhoeo, Urgenia, Scilla*).
2. Study of cell division - Meiosis (*Allium cepa, Helianthus, Tredescantia* flower buds).
3. Study of chromosomal aberrations and polyploidy.
4. Karyotype analysis – preparation of ideogram.
5. Study of special types of chromosomes.
6. Isolation of mitochondria and chloroplast (Demonstration).

Molecular Biology

1. Preparing Buffer and pH determinations; Centrifugation techniques;
2. DNA extraction from plant material.
3. Separation of plant genomic DNA by electrophoresis
4. Separation of plant proteins by electrophoresis.
5. Isolation of plasmid DNA.
6. Southern blotting (Demonstration)
7. Western blot detection of proteins (Demonstration)
8. Problems in molecular genetics: Nucleic acid chemistry, DNA transcription, Restriction Mapping and genetic code.

Books :

1. Allison.A. 2007. Fundamental Molecular Biology. Blackwell Publishing, UK.
2. De Robertis & De Robertis, 2004. Cell and Molecular Biology. Williams and Wilkins. USA.
3. Datnel, Lodish and Baltimore, 1986. Molecular Cell Biology-W.H. Freeman & Comp., New York.
4. Freifelder, 1990. Molecular Biology, Narosa Publishing House, New Delhi.
5. ary A. Schuler Raymond and E.Zrelinski, 2005. Methods in Plant Molecular Biology, Academic Press an imprint of Elsevier.
6. Peter Porella, 1998. Introduction to Molecular Biology, Mc Graw – Hill, New York.
7. Rastogi, S.C. 2004. Cell Biology. New age International Pub. New Delhi.
8. Sharma. A.K. and Sharma, A. 1980. Chromosome Techniques Theory and Practice. Oliver and Boyd, London.
9. Singh and Tomar.2004. Cell Biology. Rastogi Publishers, Meerut.
10. Swanson, C.P. 1972. Cytology and Cytogenetics. Mac Millan. New York.
11. Walker, J.M and R. Rapley, 2003. Molecular biology and Biotechnology, Panima Publishing Corporation, Bangalore.
12. Watson Baker Bell, Gana Levine Losick, 2004. Molecular Biology of the gene, Pearson Education.
13. William D. Stansfield. Jaine S. Colone Raul J. Chand, 2004. Molecular and Cell Biology, Tata Mc Graw-Hill Publishing company, New Delhi.
14. Wolfe, S.L, 1993. Molecular and Cellular Biology, Wadsworth pub, California

PAPER – 6

GENETICS AND PLANT BREEDING

GENETICS

Unit – I Classical & Modern Genetics

Mendelian inheritance - Sex determination and sex linkage –linkage, recombination and mapping – variation in chromosome number and structure-quantitative inheritance – population genetics-gene concept- molecular basis of heredity.

Unit – II Microbial genetics

Non-Mendelian Inheritance - cytoplasmic inheritance – chloroplast – Mitochondrial genome in higher plants.
Microbial genetics: Algal, Fungal, bacterial and viral genetics. Fungal mitochondrial genomes, gene mapping in bacteria and virus.
Molecular genetics: Nucleic acids as genetic material – types of nucleic acids – replication of DNA – methods and models in DNA repair mechanism – enzymes – split genes – jumping and mobilic genes – concepts of gene – cistron – muton-recon.

Unit –III Mutation genetics

Classification of Mutations - Gene Mutations: spontaneous and induced mutations – physical and chemical mutagens, molecular basis of gene mutation, point and frame shift and suppressor mutation. Gene regulatory mechanisms – Genetic disorders in human.

PLANT BREEDING

Unit - IV Breeding methods

Plant Introduction- heterosis. significance of breeding – floral biology of crop plants in relation to their breeding systems. Importance of male sterility and haploid plants in plant breeding.
Breeding methods: Methods of plant breeding in self and cross pollinated crops. National and International organizations for crop improvement

Unit – V Breeding Techniques

Selection techniques: Types of selection – pure line selection – mass selection – recurrent selection and clonal selection, Selection in segregating populations – Pedigree method, bulk method and back cross method.
Hybridization: Intervarietal, interspecific and intergeneric hybridization –Hybrid vigour. Numerical changes of chromosomes – haploids, aneuploids, secondary polyploids, euploids – auto and allopolyploids, role of polyploids and Mutation in plant breeding.

Practical:

Genetics

1. Genetics problem in Mendelian inheritance, gene interaction, quantitative inheritance.
2. Construction of chromosome map by three point crossing over.
3. Survey of genetic inheritance in a population.

Plant breeding

1. Technique of emasculation in monocot and dicot plants and bagging.
2. Techniques in selfing and hybridization.
3. Induction of polyploidy condition in plants by colchicines.
4. Methods of vegetative propagation – Layering, Budding and Grafting.
5. Effect of hormones on shoot and root induction on stem cuttings. (Demonstration)

Books:

1. Allard, R.W, 1960. Principles of plant breeding. John Willeg, New York.
2. Basu.S.B. and M.Hossain.2004. Principles of Genetics. Books and Allied (P). Ltd, Kolkatta.
3. Chaudhari, H.K. 1984. Elementary principles of plant breeding Oxford IBH..New Delhi
4. David Allen Sleper, John Milton. 2006. Breeding Field Crops. Blackwell Publishing Ltd.
5. Gardner, E.J. 1972. Principles of genetics. Willey Eastern Pvt.Ltd.
6. Gupta, P.K, 2000. Gentics. Rasatogi publications, Meerut.
7. Gurbachan and S. Miglani, 2000. Basic Genetics, Narosa Publishing House, New Delhi.
8. Hays, K.K. Immer, F.R. and Smith, D.C. 1985. Methods in plant breeding, Tata Mc Graw Hill. Newyork.
9. Neal.C.Stopskopf. 1999. Plant Breeding Theory & Practices. Scientific Publishers, Jodhpur.
10. Sambamurthy A.V. S.S. 2005. Genetics. Narosa Publishing House, New Delhi.
11. Sarin.C.2002. Genetics.Tata McGraw-Hill Publishing Co.Ltd, New Delhi.
12. Singh,B.D. 2001. Plant Breeding, Principles and Methods. Kalyani Publications, , New Delhi
13. Singh.B.D.2005.Genetics.Kalyani Publishers. New Delhi.
14. Verma, P.S and V.K. Agarwal, 2007. Genetics. S.Chand & Co, New Delhi.
15. Vijendra Das, L.D. 2005. Genetics and Plant Breeding, New Age International (P) Ltd., New Delhi.

ELECTIVE
PAPER – 2
(Choose either A or B or C)
A. HERBAL BOTANY

UNIT –I

Historical background of medicinal practices in India. Importance and relevance of medicinal drugs in India. Comparative account of various systems of medicine in India—like Siddha, Allopathy, Unani and Homeopathy. Phamacognosy – Aim, scope, branches and importance. Study of Phytochemicals—reserve materials, secretory materials and excretory materials.

UNIT – II

Medicinal gardening – garden in the hills and plains, house gardens, important plants for gardening. Poisonous plants of India—Types of Plant poison- active plant poison--- treatment for plant poisons, Some important poisonous plants, their toxicity and action.

UNIT – III

Adulteration of crude drugs and its detection—methods of adulteration, types of adulteration. Medicinal plants of export values. Rejuvenating herbs—role of non flowering plants in the field of medicine.

UNIT-IV

Botanical description and active principle components of root, rhizome, wood and bark drugs.
Botanical description and active principle components of leaves , flowers, fruits, seeds and entire plant as drug.

UNIT –V

Taxonomy study of some selected herbs—*Acalypha indica, Achyranthes aspera, Aloe vera, Alternanthera sesselis, Centella asiatica, Cynodon dactylon, Coleus aromaticus, Ocimum sanctum, Phylanthus amarus, Solanum trilobatum*. The endemic medicinal plants of India. Conservation of existing and endangered medicinal plants.

Books

1. Agarwal, O.P,1985.Vol-II. Chemistry of of organic – natural products.
2. Chopra,R.N., Nagar,S.L and Chopra,I.C.1956. Poisonous plants of India.
3. Chopra,R.N., Chopra,I.C ., Handa, K.L.,and Kapur,L.D.1994.Indigenous drugs of India.
4. Chopra,R.N., Badhuvar,R.L., and Gosh,g.1965. Poisonous plants of India.
5. Bhagwan Das—Fundamentals of Ayurveda.
6. Kandasamy Pillai,1972. History of Siddha medicine. Govt. of Tamilnadu.
7. Krup,P.V. Handbook of medicinal plants Vol I &II, CCRIMH, NewDelhi.
8. Nadkarni,K.M.,1976.Indian Materia Medica Vol I &II, Popular Prakashan Pvt. Ltd.
9. Wallis,T.E.,1967. Text book of Pharmacognosy, J.A. Churchill Ltd.

ELECTIVE
PAPER – 2

(Choose either A or B or C)
B. TECHNIQUES IN BOTANY

UNIT – I Microscopy and Microscopic measurements

Principles, image formation and applications of Light, Polarizing, Transmission and Scanning electron microscopes; Material preparation for Electron microscopy study. Photomicrography--- Digital imaging. Microscopic measurements: Micrometers – Ocular and Stage; Haemocytometer and Camera Lucida.

UNIT – II Microtechniques

Microtomes : Rocking, Rotary, Sledge and Ultra microtomes and their uses. Sectioning of Biological specimens - Free hand, Hand microtome, sludge and rotary microtome sectioning. Techniques for microtome sectioning. - Killing and fixing, fixatives, dehydration and dehydrating agents, Embedding, Dewaxing, Clearing, staining of the sections, Mounting and mountants, Fixing coverslips and ringing.

UNIT – III Histochemical studies

Introduction to Histochemical techniques – staining of Proteins, Carbohydrates, and Lipids. Microslide preparation—Whole mounts, Smears and Squashes. Maceration technique.

UNIT – IV Molecular Techniques

Blotting techniques- Southern, Northern and Western; ELISA; RIA and PCR. DNA finger printing; RFLP; RAPD and FISH techniques. Electrophoresis – General principles – Electrophoresis- Agarose gel; SDS –PAGE.

UNIT – V Tissue culture techniques

Introduction - tissue culture techniques - laboratory organization – preparation of nutrient media. Methods of sterilization – Chemical and Physical methods. Preparation of explants – callus initiation, subculture and hardening. Concepts of totipotency and redifferentiation. Cell suspension culture – callus culture, Anther and pollen culture – haploids and their significances. Embryo culture - Meristem culture for virus-free clones.

Books:

1. Allan peacock, H. 1966. Elementary Microtechnique. Edward Arnold Publ.
2. Bancroft, J.D, 1967. An introduvction to Histochemical technique. Appleton, Century Crofts, New York.
3. Berlyn, P.G, 1986. Botanical microtechnique and cytochemistry.
4. Duddington, C.L, 1960. Practical microscopy. Pitman publ.
5. Gahan, P.B, 1984. Plant histochestry and Cytochemistry- An introduction. Academic press, U.K.
6. George, E.F. and Sherrington, P.D. 1984. Plant propagation by tissue culture. Freeman Publishers, London.
7. Gray, P. 1964. Hand book of basic microtechnique. MacGraw Hill , New Delhi.
8. Jayaraman, J. 1992. Techniques in Biology. HigginBothams Pvt Ltd, Chennai.
9. Johnson, D.A, 1940. Plant microtechnique. MacGraw Hill , New Delhi.
10. Kiernan, J.A, 1990. Hisological and Histochemical Methods. Theory and practice. Permagon press, U.K.
11. Krishnamurthy, K.V, 1988. Methods in plant histochemistry. Viswanathan printers and publishers, Chennai.
12. Lindsley,K. 1992.Plant tissue culture manual. Kluwer Academic publishers.
13. McClung, C.L, 1961. Hand book of Microscopic technique. MacGraw Hill, New Delhi.
14. Purvis, C.J., Collen, D and Walls, D. 1966. Laboratory technique in Botany. Orient Longman, Singapore.
15. Reinert .J and Yeoman, M.M 1983 Plant cell and Tissue culture- Laboratory manual, Narosa publishing house, New Delhi
16. Prasad and Prasad, 2000. Outlines of Microtechnique. Emkay publ, New Delhi.
17. Sharma 1993 Instrumental methods of chemical analysis. S. Chand & CO. New Delhi.
18. Thorpe, T.A. 1981. Plant tissue culture methods and application in agriculture, Elsevier, London Timir Baran Jha and Biswajit Ghost, Plant tissue culture (Basic and Applied). University Press, Hyderabad. 2005
19. Wilson, K. and John walker, 1999. Principles and techniques in practical Biochemistry, Springer publication, London.
20. Yeoman, 1987. Plant cell culture Technology. Narosa publishing house, New Delhi.

ELECTIVE

PAPER – 2

(Choose either A or B or C)

C. INDUSTRIAL MICROBIOLOGY

UNIT-I

Exploitation of Micro organisms and their products. Screening, Strain development strategies, immobilization methods, fermentation media- raw material used in media production. Antifoaming agents. Buffers. Downstreams processing.

UNIT – II

Fermentation -Equipment and its uses, fermentor design, types of fermentors and fermentations – batch, continuous, multiple, surface, submerged and solid state.

UNIT – III

Industrial products from micro organisms – anti biotics: production of penicillin. Streptomycen. Interferons. Vaccines. Hormones. Vitamins.

UNIT – IV

Enzymes from micribes: amylase, protease. Organic acids: Citric acid, Acetic acid, Amino acids: Glutomic acids, Lysine

UNIT – V

Production of alcoholic beverages: Beer and wine, bio fuels : ethanol methane, biogas

BOOKS

1. Ananthanarayanan R and C.K. Jayaraman Paniker (2005) Text Book of Micro – Biology 7th Eddition, Orient Longman Pvt. Ltd.
2. Dubey and Maheswary DK (2005) A Text Book of Micro – Biology Revised multi colour edition published by S. Chand & Company Ltd., New Delhi.
3. James M Jay, 2004, Modern Food Micro Biology, CBS Publishers & distributors, New Delhi.
4. L.E. Cssida JR, Industrial Micro biology. Published by New Age International Pvt. Ltd., New Delhi
5. Patel AH 2005. Industrial Micro Biology. Published by Macmillan India Ltd., new Delhi.
6. Pelzer M.J. J.R and Chan E.C.S. 1981 Elements of Micro Biology Mcgraw Hill Inter. Book Co.
7. Prescott M 2002 Micro Biology 5th edition. Tata Mcgraw Hill International Book Co.
8. Whitaker and Stanbury. Principles of fermentation technology

SEMESTER III

PAPER – 7

TAXONOMY OF ANGIOSPERMS, BIODIVERSITY AND ECONOMIC BOTANY

Unit-1 Morphology

Leaf: Parts, stipules, blade, venation, modification and phyllotaxy.
Stem: Parts, forms, buds, modification of stem and buds.
Flower: Parts, androecium, gynoecium, placentation and inflorescence.
Fruits: Parts, types and classification.
Seeds: Parts, types and classification.

Unit –2 Nomenclature and Classification of Angiosperms

Historical account on classification of angiosperms (classification of Linnaeus, Bentham and Hooker, Engler and Prantl Takhtajan and Arthrur Cronquist. Adetailed account of APG3 classification. Biosystematics and Modern Taxonomy, Chemotaxonomy and Numerical taxonomy.

Principles of ICBN--Typification, Principles of priority and their limitations Citation, key for identification of plants, General indexes, Monographs, Periodicals, Floras and Manuals, Data banks, Use of molecular tools in taxonomy, Use of Cladistics methodology in Taxonomy.

Unit – III Families of Angiosperms

A detailed study of the following families and their interrelationship and phylogeny

Nymphaceaea, Menispermaceae, Malvaceae, Zygophyllaceae,
Malphighiaceae, Rhamnaceae, Sapindaceae, Myrtaceae,
Combretaceae, Lythraceae, Passifloraceae, Apiaceae.

Unit – IV Families of Angiosperms and Biodiversity

Boraginaceae, Scrophulariaceae, Lamiaceae, Acanthaceae,
Commelinaceae, Poaceae, Typhaceae.

Levels and types of Biodiversity, Status and values of the Biodiversity, hot spots, Endemism, IUCN, Red list categories, National Biodiversity Act.

Unit – V Plants in Human Welfare

A general account of cultivation and utilization of food crops—Cereals(Paddy and Ragi), pulses (Blackgram and Dhal). Spices – Pepper and cardomen; oils— Sesame and Groundnut oil, Eucalyptus and Citronella oil. Commercial crops—Sugar cane, Rubber, Tea, Fibers- Cotton, Jute; Timbers- Teak and Dalbergia. Drug yielding plants—*Phyllanthus amarus* and *Solanum trilobatum*. Adulterant.

Practical:

Angiosperm taxonomy

1. Detailed study of the families mentioned in the theory with two representative species from the local area.
2. Familiarity of the binomial nomenclature of the available species from the local flora using Gamble's flora.
3. Herbarium preparation.

Economic Botany:

1. Identification of family, genus, species and morphology of the useful parts of plants mentioned in the theory.

Books

1. Cronquist, A. 1968. The evolution and classification of flowering plants. Houghton Miffin, Boston.
2. Davis, P.H. & V.H. Heywood, 1968. Principles of Angiosperm Taxonomy, Oliver & Boyd Edinburgh & London.
3. Dutta, S.C. 2003 Systematic Botany, New age International (P) Ltd, Publication, New Delhi.
4. Gamble, J.S. 1956. Flora of the presidency of Madras . Vol. I,II & III. Bishen singh Mahendra palsingh, India.
5. Greuter,W.,1988. International code of Botanical nomenclature. Today and tomorrow's printers and publishers, New Delhi.
6. Gurucharan singh, 2004 Plant systematic, Oxford & IBH Publishing company (P) Ltd, New Delhi
7. Heywood, V.H, 1967.Global Biodiversity assessment. Cambridge University press, U.K.
8. Heywood, V.H, 1967. Plant taxonomy. Edward Arnold Ltd, U.K.
9. Hutchinson, J. 1934. The families of flowering plants . vol I & II, Clarendon press, Oxford.
10. Jain, S.K.and R,R,Rao, 1977. A handbook of field and herbarium methods. Today and tomorrow's printers and publishers, New Delhi.
11. Jones,S.Dand A.E. Luchsinger, 1987. Plant systematics. Tata McGraw-Hill, New York
12. Lawrence, G.H.M. 1964, Taxonomy of Vascular plants, Oxford & IBH Publishing company (P) Ltd, New Delhi.
13. Pandey.B.P. 2009. Taxanomy of Angiosperms. S.Chand & Co. Ltd. New Delhi.
14. Quicke, D.L.J, 1993. Principles and techniques of contemporary Taxonomy, Chapman and Hall, London.
15. Naik, V.N. 2002. Taxonomy of Angiosperms, Tata McGraw-Hill, New York
16. Rendle, 1967 The classification of flowering plants Vol. I & II, Vikas publishing house, (P) Ltd., New Delhi.
17. Sambamurty, A.V.S.S, 2005. Taxonomy of Angiosperms, I.K. International Pvt. Ltd.,
18. Sivarajan, V.V., 1999. Principles of plant taxonomy, Oxford and IBH
19. Stace, C.A, 1989. Plant taxonomyand Biosystematics. Edward Arnold, London.
20. Subramanium, N.S, 1995. Modern Plant taxonomy. Vikas publishing house, New Delhi.

PAPER – 8

BIOTECHNOLOGY AND GENETIC ENGINEERING

Unit – I Biotechnology

Definition, Introduction, history, Scope, Potentialities and constraints. Fermentation Process – traditional and modern biotechnology; General requirements of fermentation processes.: Types and design of fermentors. Algal biotechnology. Fungal biotechnology.

Unit – II Industrial Biotechnology

Production of industrial enzymes - amylases, lipases, cellulases and protease. Methods of enzyme immobilization and applications. Production of biogas, and alcohol. Production of Single cell protein, biopesticides and biofertilizers. Production of biopolymers. Pants as bioreactors: Edible vaccines - Production of antibiotics.

Unit – III Application of Plant Biotechnology

Transgenic plants: Resistance to biotic stress – insect and pest resistance: resistance from microorganisms. Resistance to abiotic stress: herbicide, glyphosate, phosphinothricin, sulfonylureas and imidazolinones. Transgenic plants as bioreactor- molecular pharming, therapeutic products. Biotechnology of nitrogen fixation: Nitrogenase - *Nif* genes and their organization - Genetic engineering of nif genes in yeast cells.

Unit – IV Gene cloning

Basic principles: Restriction endonucleases - Cloning vectors – plasmids, phages and cosmids, Transposans, primary vectors and plasmids—expression vectors. - Methods of gene transfer – transformation, conjugation, electroporation, liposome mediated gene transfer, transduction, direct transfer of DNA, viral vectors, particle gun method and microinjection; Ti plasmid mediated transfer –*Agrobacterium tumifaciens.* Gene cloning strategies.

Unit – V Genomics, IPR and Bioethics

Genomics: Definition--Preparation of genetic maps: Molecular genetic maps – cereals, legumes, and forest trees - Genomics for evolutionary studies.
Gene cloning**:** Genomic and c-DNA libraries - Choice of host organisms for cloning- bacteria, plants and yeast. Gene addition and deletion approach in genetic engineering.
Human genome project. Gene theraphy. IPR – patents, Trade secrets, Copy rights and Trade marks, Geographical indications, ethical issues of patenting.

Practical:

1. Isolation of single cell protein (*Spirulina*).
2. Demonstration of Immobilization of yeast cells.
3. Demonstration of PCR technique with known primers.
4. Bio control of plant insects using *Bacillus thuringianensis.*
5. Preparation of plasmid DNA.

Books:

1. Alan Bruce and John W. Palfreyman, 2004. Forest products Biotechnology, Taylor and Francis. New York.
2. Alan Scragg, 2005. Environemntal Biotechnology. II Edition. Oxford University Press. New York.
3. Bernard R. Glick and Jack J. Pasternak, 2001. Molecular Biotechnology – 2nd edition, ASM press Washington DC.
4. Brown, C.W, I.Campbell and F.G. Priest, 1987. Introduction to Biotechnology. Blackwell scientific publications, Oxford.
5. Chawla, H.S, 2000. Introduction to Biotechnology. Oxford & IBH Publishing Co Pvt. Ltd, New Delhi
6. Gupta, P.K. 2003. Biotechnology and Genomics, Rastogi Publisher, Meerut/
7. Hammond,J , P. Mc Garvey and V. Yusibov . 2002. Plant Biotechnology –New products and applications, Springer – Verlag, Heidelberg.
8. Hans-Peter Schmauder. 2005. Methods in Biotechnology. Taylor & Francis. London.
9. Ignachimuthu, S.1997. Plant Biotechnology, Narosa publishing House, New Delhi.
10. John.A.Thomas. 2004. Biotechnology and safety Assessment. II Edition. Taylor & Francis. London.
11. Kumar, H.D. 2004. A textbook on Biotechnology – 2nd edition, Affiliated East West press Pvt., Ltd., London.
12. Marx, F.L, 1989. A revolution in Biotechnology. Cambridge University press, New York.
13. Ranat, K.G. and J.M. Merillon. 2003. Biotechnology: Secondary Metabolites. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
14. Rastogi, S.C. 2007. Biotechnology- Principles and Applications. Narosa Publishing House, New Delhi.
15. Sathyanarayana, U., 2009. Biotechnology. Books and allied (P) Limited.
16. Sridhar, S. 2005. Enzyme Biotechnology, Dominant publishers and Distributors, New Delhi.
17. Trehan, K. 1990. Biotechnology. Willey eastern Limited, New Delhi.
18. Trevan M.D, S. Boffey, K.J Goulding and P.Stanburg, 1977. Biotechnology: The Biological principles. TATA Mc Graw – Hill, New Delhi.
19. Thiel, Bissen, Lyons, 2004. Biotechnology, TATA Mc Graw – Hill, New Delhi.
20. Walker, J.M. and R. Repley. 2006. Molecular Biology and Biotechnology. IV Edition. Panima Publishing Company, New York.

PAPER – 9

ECOLOGY AND TOXICOLOGY

Unit – I Ecosystem and energy cycle

The Environment: Biotic and abiotic components. Ecosystem: Concept, structure and function, producer, consumers, decomposers, Energy flow – ecological succession. Food chain, food web and ecological pyramids. Biogeochemical cycling – basic types: the water, Carbon Phosphorous and Nitrogen cycles.
Introduction, types characteristics features, structure and functions of the following Ecosystem: Forest, grassland, desert and aquatic (ponds, streams, laks, riversoceans, estuaries).

Unit - II Study of Vegetation

Autecology and Synecology . Ecological life cycle – species interaction – types – Population Ecology and its characteristics – density , Mortality, Natality. Survival and r and k selection. Ecological Niche –ecotone and edge effect Methods of studying vegetation – Qualitative and Quantitative characters – Quardrat studies. Density, Abundance, frequency and IVI, Polygraph charting – Raunkiaer's Life forms.

Unit III Evolution of Ecosytem

Development and evolution of ecosystems-- Ecological succession-causes—migration—ecesis—aggregation---- colonization and stabilization of plant communities—Climax and sub climax—concepts of climax and stability of ecosytem. succesion in pond, rocks bogs and sand dunes---. Mechanism, changes involved in succession and theories of succession. Plant indicators.

Unit - IV Conservation ecology

Principles of Conservation: Natural resources—types--Conservation of Natural Resources --- alternative resources. Global Environmental changes: Deforestation its role in Global warming and Climate change. El Nino—its role in climate change. Public Awareness - Environmental Protection Act and Environment movements.

Unit - V Toxicology

Toxicants – Classification – Origin and source and toxic effects —branches of
Aerotoxicants: Sources, causes, effects and control of toxicants released into the atmosphere--- oxides of carbon , sulphur, nitrogen—PAN –hydrocarbons--
Photochemical smog, Green house effect, Ozone layer depletion and Acid rain.
Toxicants in Aquatic bodies— Industrial wastes -- heavy metals, agricultural wastes – pesticides, insecticides etc., -- effect of nitrogenous wastes mercury, chromium--- bioaccumulation – bioabsorption—Biotranslocation—Eutrophication—algal bloom. Effect of toxicants on soil and soil living organisms. Effect of toxicants released from solid wastes and E-wastes.

Practical:

Ecology: Methods of studying vegetation

1. Quadrat method: List quadrat, count-quadrat and minimum size of quadrat for given vegetation.
2. Find the density, abundance and frequency of given vegetation by meter quadrat method.
3. Transect method: Line transect, belt transect and bisect method.
4. Find the Relative frequency, relative density and relative dominance for given vegetation. Important value index and polygraph charting.
5. Phenology study: Each student has to select a plant and prepare a report on the phenology.
6. Ecological adaptation of plants.
7. Ecological instruments.

Toxicology:

1. Effect of DDT and weedicides on seed germination.
2. Effect of industrial effluents on seed germination.
3. Estimation of the dust pollution on plants.
4. Estimation of turbidity and TDS.
5. Estimation of pH, BOD and COD.

Books

1. Agarwal, K.C, 2001. Fundamentals of Environmental Biology, S.Chand, New Delhi.
2. Ambasht, R.S, 1976. A text book of plant Ecology, Students Friends & Co, Varanasi.
3. Aulay Mackenzie. Andy, S. Ball and Sonia R.Virdee, 2002. Instant notes Ecology 2nd edition, Viva books, Chennai.
4. Claude Fauric, Christiane Ferra, Paul Medori and Jean Devaux, 2001. Ecology science and practice special Indian edition, Oxford & IBH.
5. Dash, M.C, 2004. Fundamentals of Ecology, Tata McGraw, Hill, New Delhi.
6. Duffous, J.H, 1980. Environmental Toxicology. Edward Arnold Publication, London.
7. Gates, D,M, 1980. The Biophysical Ecology. Springer- verlag, New York.
8. Kormondy, E. 1989. Basic concepts of Ecology. Prentice Hall of India, New Delhi.
9. Larcher, W. 1983. Physiological Ecology of plants. Springer- verlag, New York.
10. Odum, E.P. 1978. Basic Principles of Ecology., Thomson, Brooks/cole, Austrialia.
11. Odum, E.P. Gary W. Barrelt, 2004. Fundamentals of Ecology – 15th edition, Thomson Asia Pvt., Ltd.,
12. Sharma , P.D, 1993. Environmental Biology and Toxicology. Rastogi Publications, Meerut.
13. Singal, S.P 2005. Noise pollution and control strategy, Narosa Publishing Hose, New Delhi.
14. Shukla, R.s and P.S. Chandel, 207. A text book of Plant Ecology. S. Chand & Co, New Delhi.
15. Wyman, R.L. 1991. Global climate change and life on earth. Routledge, Chapman and Hall, Inc, New York.

ELECTIVE
PAPER – 3
(Choose either A or B or C)

A. PLANT TISSUE CULTURE

UNIT – I Introduction

Plant cell – Totipotency – culture of plant cells, tissue and organs, scope, historical review. Organization of Plant tissue culture laboratory – Aseptic techniques. Culture media, preparation and composition – Methods of sterilization—methods to overcome phenolic oxidation—inoculation – incubation – hardening.

UNIT – II Preparations

Preparation of explants – Callus—Dynamics of callus growth—callus initiation and maintenance – Metabolic patterns in callus culture—Morphogenesis in callus culture—Organogenesis--rhizogenesis, caulogenesis - Hardening. Root culture – Cell suspension cultures.

UNIT – III Micro propagation

Micropropagation – Shoot apex culture – Somatic embryogenesis – Isolation, purification and culture of protoplasts. Protoplast fusion, morphogenesis and somatic hybridization. Protoplast regeneration, Organogenesis and embryogenesis. Identification and selection of fusion hybrids—uptake of organelles

UNIT – IV Haploids and variations in tissue culture

Anther and pollen culture – Segmentation pattern in pollen—Pollen patterns from haploids. Diploidization of haploids to produce homozygous plants—factors influencing adrogenesis—pollen dimorphism. haploidy through alternative sources—gynogensis. Haploid mutants – utilization of haploids in agriculture. Somoclonal variation, gametoclonal variartions – Production of tolerant plants for various stresses.

UNIT – V Application of Tissue Culture

Cytodifferentiation in tissue culture, Primary steps in differentiation and redifferentiation. Application of tissue culture in plant pathology, medicine and biosynthesis of secondary metabolites, Production of secondary metabolites and single cell proteins by cell culture – Artificial seed, Rapid propagation of Eucalyptus – Banana – Rose and orchids. Tissue culture as a tool for Bio- technology. Methodology to develop transgenic plants like herbicidal resistance .

Books:

1. Ammirato, P.V, D.A. Evans, W.R. Sharp and Y.P.S Bajaj,1990. Hand book of Plant cell culture. Vol V. Ornamental Species. McGraw Hill Publishing company, New York.
2. Butcher, D.n and D.S. Ingram,1982. Plant tissue culture. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
3. Butenko, R.G, 1985. Plant cell culture. MIR Publishers, Moscow.
4. Dixon, R.A, 1985. Plant cell culture—A practical approach. IRL press Oxford, London.
5. Dodds. J.H and L.N. Roberrtis (1985) Experiments in plant tissue culture, Cambridge University Press – New York.
6. Kalyan Kumar D.E.1992. Plant tissue culture, Agrobios, New Delhi.
7. Lindsley,K. 1992.Plant tissue culture manual. Kluwer Academic publishers.
8. Narayanaswamy, S. 1994. Plant cell and tissue culture. Tata McGraw Hill Publishing company,Ltd. New Delhi.
9. Purohit, S.S and S.K. Mathur, 1993. Fundamentals of Biotechnology. Agrobotanical publishers, India.
10. Razdan.M.K.2003. Introduction to Plant Tissue Culture. Oxford & IBH Publishing C.Pvt.Ltd, New Delhi.
11. Reinert .J and Yeoman, M.M 1983 Plant cell and Tissue culture- Laboratory manual, Narosa publishing house, New Delhi.
12. Street, H.E, 1977. Plant tissue culture. Blackwell scientific pub, Oxford.
13. Thorpe, T.A. 1981. Plant tissue culture methods and application in agriculture, Elsevier, London Timir Baran Jha and Biswajit Ghost, Plant tissue culture (Basic and Applied). University Press, Hyderabad. 2005
14. Wilson, K. and John walker, 1999. Principles and techniques in practical Biochemistry, Springer publication, London.
15. Yeoman, 1987. Plant cell culture Technology. Narosa publishing house, New Delhi.

ELECTIVE
PAPER – 3
(Choose either A or B or C)

B. FORESTRY, PLANT GEOGRAPHY AND BIODIVERSITY

UNIT I– Fundamentals of Forestry

Methods of studying forest area—Aerial survey--- Photographic method – remote sensing techniques. Forest types of India—forest floor – canopy—sholas and its importance. Silvicultural practices—Clear felling, Simple coppice method, Selection felling system. Forest mensuration – measurement of height, girth, estimation of volume. Use of wedge prism.Forest products--- major and minor products.

UNIT – II Silviculture System

Silviculture method and its importance to raise important trees. Silviculture methods practicised for the development of trees like—Tectona grandis, *Santalum album, Bamusa arundinacea, Dendrocalamus strictus, Euclayptus, Mangifera and Casuarina*.
Forest management--- rotation of crops working plan—Kumri method, Afforestation measures—Community forestry, Agroforestry, social forestry, farm forestry, village forestry and road side avenues.

UNIT-V Plant geography

Principles of Plant geography- dispersal and migration. Geographical patterns- World flora-Types and patterns of distribution of vegetations- vegetational types – Major Biomes of the World – Biogeographical zones of India and Tamilnadu. Continuous and discontinuous of plant distribution-continuous range, cosmopolitan, circumpolar, circumboreal and circumaustral, pantropical distribution. Endemism – types– endemic plants of the World. Age and hypothesis - Wegner's theory of continental drift and plant distribution.

UNIT - IV Biodiversity

Biodiversity-introduction, definiction: genetic, species and ecosystem diversity. Biogeographical classification of India. Values of biodiversity: consumptive uses, productive use, scial, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as mega-diversity nation. Hot – spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India.

UNIT – V Conservation of Bioiversity

Biodiversity Management approaches. Convention: Biodiversity Act of India.
Conservation: Insitu and Exsitu conservation of Biodiversity
IPR for plant breeding: Plant variety protection - Plant breeder's right - Farmer's rights - Patenting system in India - Patent information and service.

Books

1. Agarwala, V.P, 1978. Forests of India. Oxford& IBH, New Delhi
2. Ahmedullah, m and M.P. Nayar. 1987. Endemic plants of the Indian region. Vol I , Botanical survey of India, Howrah.
3. Alan Bruce and John W. Palfreyman, 2004. Forest products Biotechnology, Taylor and Francis. New York.
4. Collinson, A.S, 1988. Introduction to world vegetation. Unwin Hyman.
5. Cox, B. I.N. Healy and P.D.Moore. Biogeography. The ELBS publication ,Oxford & IBH.
6. Dobson, A.P , 1996. Conservation and Biodiversity. Scientific American Library, New York.
7. Gleason, H.A, and Arthur Cronquist, 1964. The natural geography of plants. Columbia University press, New York.
8. Good Ronald, 1974. The geographyn of flowering plants. Longman publication, London.
9. Groombridge, B,1992. Global Biodiversity: Status of the Earth's living resources. Chapman and Hall, London.
10. Heywood, V.H, 1967.Global Biodiversity assessment. Cambridge University press, U.K.
11. Jacobs,M. 1981. The tropical rain forest. . A first encounter. Pringer—verlag, New York.
12. Kothari, A. 1989. Understanding Biodiversity—Life sustainability and equity. Orient Longman, New Delhi.
13. Longman, K.A. and J.Janik, 1987. Tropicaql forests and its environment. Longman publication, London.
14. Moore, R, W.D Clark, K.R. Stern and D. Vodopich, 1995. Plant Biodiversity, Wim. C. Brown publishers, London.
15. Nayar, M.P. and R.K. Sastry, 1987-1990. Red date book on Indian plant Vol III, Botanical Survey of India, Howrah.
16. Nayar, M.P.1996. "Hot spots" of endemic plants in India, Nepal and Bhutan. TBGRI, Thiruvanthapuram, India.
17. Pears, N. 1977. Basic Biogeography. Longman publication, London.
18. Puri, G.S. Gupta, R.K. Meher- Homji and S.Puri, 1989. Forest Ecology. (Vol I & II). Oxford & IBH publication, New Delhi.
19. Takhtajan, A. 1986. Floristic regions of the world. University of California press, Berkeley.
20. Willis, A.J, 1973. Introduction to Plant Geography. George Allen Publ.

ELECTIVE

PAPER – 3

(Choose either A or B or C)

C. HORTICULTURE AND LAND SCAPING

Unit – I - Garden Design and Landscaping

Garden and Garden design. Knowledge of plants – Soils- Irrigation – Transplanting

Potting- Soil less culture.

Lawn – Rock garden – Rosary – water garden – terrace garden – Kitchen garden –Landscaping- Fences for utility and beauty – Archers and pergolas – Green house and glasshouse – summer house.

Unit- II - Propagation

Propagation techniques – Sexual propagation – Seed – Seed dormancy – Seed germination – Vegetative cuttings – Layering – grafting – Budding – Stocks – Scion relationships – micro Propagation.

Unit – III - Nutrition and Diseases

Manures and Manuring – Training and pruning – Irrigation techniques.
Use of plant growth regulators in horticulture – Some important diseases of Horticultural plants and plant protection.

Unit – IV - Floriculture and Pomology

Culture of Economically important flowers : Jasmine – Rose – Cut flowers.
Fruit culture : Mango – Guava – Banana - Papaya.

Unit – V - Post harvest technology

Flower arrangements and decorations- harvesting – Marketing - post harvest
Storage of fruits and vegetables – Preservation of fruits and vegetables.

Books:

1. Bose T.K. 1990. Fruits of India. Tropical and subtropical, Naya Prakash, Calcutta.
2. Bose .T.K. Som. M.G. and Katrir. J. 1993. Vegetable Crops, Naya Prakash, Calcutta.
3. Bose .T.K. and D.Mukherjee. 1987. Gardening in India, Naya Prakash, Calcutta.
4. Bose .T.K.. and C.P. Yadav. 1989. Commercial flowers, Naya Prakash, Calcutta.
5. Edman, J.B. T.L. Senn, F.S. Andrews and R.G. Halfacre, 1988. Fundamentals of Horticulture, Tata MacGraw Hill Publishing house company, New Delhi.
6. Hartman. H.T. and Kester D.E . 1986. Plant propagation principles and practices Prentices Hall of India Ltd., New Delhi.
7. Janick. J.W.H. 1988. Horticulture Science. Freeman and Co., Sanfrancisco.
8. Nambisan .K.M.P. 1992. Design Elements of Landscape Gardening- Oxford and IBH Publications.
9. Prasad,S and U.Kumar, 1999. Principles of Horticulture. Agrobotanica, bikaner
10. Shanmugavelu K.G. 1989. Production Technology of vegetable Crops. Oxford India. Publication, New Delhi.

SEMESTER IV

PAPER – 10

PLANT PHYSIOLOGY

Unit – I Plant cells and water

Water and hydrogen bonds – Physical and chemical properties of water – water in soil – water absorption by roots – water transport through the xylem – soil, plant, atmosphere continuum concept (SPAC concept) – Transpiration and evapotranspiration – stomata structure and function – mechanism of stomatal opening and closing – mineral nutrition – essential nutrients – macro and micro nutrients – deficiencies and plant disorders – absorption of solutes – translocation of solutes – pathway and mechanism.

Unit – II Photosynthesis

Ultrastructure and biochemical components of chloroplast – structure and function of photosynthetic pigments – biosynthesis of chlorophyll—Van neil Hills reaction—Red drop phenomenon—Emerson enhancement effect – Photo protective mechanisms - mechanism of electron transport – photophosphorylation (PS-I & PS-II) – proton transport –Z- scheme – pseudocyclic electron flow and ATP synthesis. C_3, C_4 and CAM pathways and their distinguishing features - photorespiration and its significance, RuBISCO.

Unit – III Respiration and Nitrogen Metabolism:

Respiration – overview of plant respiration – glycolysis – TCA cycle – electron transport and ATP synthesis –pentose phosphate pathway – glyoxylate cycle – electron transport and ATP synthesis at the inner mitochondrial membrane – respiration and its significance in crop improvement. Secondary metabolism in plants. Nitrogen Metabolism: Nitrate and Ammonium assimilation, Amino acid biosynthesis.

Unit – IV Plant growth and development

Definition of growth – growth factors – growth correlation – growth dynamics and growth analysis – Growth regulators – auxin, gibberellins, cytokinins, abscisic acid, ethylene,– commercial application of growth promoters and retardants in agricultural and horticultural crops – photoperiodism – classification of plants and mechanism of flowering in photoperiodic sensitive plants – theories related to flowering – phytochrome and their action on flowering – vernalization mechanism and their practical application – plant senescence and fruit ripening and their biochemical mechanism - classification of plant movements – phototrophism - geotrophism – hydro and chemotropism.

Unit – V Stress Physiology

Responses of Plants to Biotic (Pathogen and insects) stresses and mechanism of resistance to Biotic stress. Water stress – water deficits and plant growth - physiology and biochemical functions affected by water stress – Drought-its definition and quantification – adaptive strategies for drought resistance (Avoidance, escape and tolerance) Saline and alkaline soils – salt stress injury – mechanism of salt tolerance in halophytes. Seed dormancy. Cell signaling: Signaling through G-Protein coupled receptors - signal transduction pathways- regulation of signaling pathways.

Plant Physiology Practical:

1. Determination of osmotic potential by plasmolytic method.
2. Determination of water potential using gravimetric method.
3. Determination of water potential using dye method (Chardakov's method).
4. Effect of Monochromatic light on apparent photosynthesis**.**
5. Effect of CO_2 concentration on apparent photosynthesis.
6. Effect of temperature on protoplasmic membrane.
7. Separation of chloroplast pigments using paper chromatographic technique.
8. Estimation of chlorophyll content by Arnon's method.
9. Determination of rate of photosynthesis using O_2 electrode.
10. Determination of Relative Water Content.
11. Tetrazolium test for seed viability.

Books:

1. Audus, L.J. 1972. Plant growth substances, Leonard Hill.
2. Bidwell.R.G.S, 1974. Plant physiology. Macmillan pub, Co, New York.
3. Devlin, R.M. 1996. Plant physiology, PWS publisher, Boston.
4. Gardner, F.G., R.B. Pearce and R.L. Mitchell. 1985. Physiology of crop plants. Scientific publishers, Jodhpur.
5. Khan, A.A. 1977. Physiology and Biochemistry of Seed dormancy and germination, Oxford & IBH Publishing company (P) Ltd, New Delhi.
6. Online resources available at internet sites
7. Kozlowshki, T. 1968. Water deficit and plant growth. Vol. II., Academic Press. New york.
8. Leopold, A.C, 1994. Plant growth and development, McGraw Hill, New York.
9. Levitt, J. 1969. Introduction to Plant physiology, Morsby International Ed., London.
10. Lincoln Taiz and Eduardo Zeiger, 2005. Plant Physiology Sinauver Associates Inc. Publishers, Sunderland, Massachusetts.
11. Panda, S.K, 2005. Advances in Strees Physiology of plants, Scientific publishers India, Jodhpur.
12. Price, C.A. 1970. Molecular approaches to Plant Physiology, McGraw Hill, Book company, London.
13. Salisbury, F.B and Cleon Ross, 2007. Plant physiology, Wadsworth publishing company, Belimont.
14. Slatyer, T.O. 1961. Plant water relationship, Academic press, New york.
15. Street H.E. and W. Cookborn. 1972. Plant metabolism, E.I.B.S. Ed., Pergamon press, New York.
16. Suteelife, J.F. 1968. Plant and Water, E.I.B.S. Ed., Pergamon press, London.
17. Ting,I.P, 1982. Plant physiology. Addision Wesley Pub Co., New York.
18. William G. Hopkins, 1999. Introduction to Plany Physiology, John Wiley and sons, INC, New York.

PAPER – 11

PLANT BIOCHEMISTRY AND BIOPHYSICS

UNIT-I: Structure of Atom and Chemical Bonds

Atomic structure—Nature and types of chemical bonding—ionic bond—covalent bond—co-ordination bond, hydrogen bond, Semipolar bond, Hydrophobic or nonpolar interactions, Vander Waals interactions. Hydrogen concentration, Buffers—Biological buffer systems—Phosphate, Bicarbonate, Protein, Amino acid and Haemoglobin buffer systems.

UNIT-II: Carbohydrates

Biomolecules—Carbohydrates—properties of mono, oligo and polysaccharides. Structure and functions of trioses, pentoses hexoses, maltose, sucrose, starch and pectic glycosidic linkage, de-oxysugars, glycoproteins, aminosugars, isomerism and mutarotation.

UNIT-III: Amino acids and Proteins

Biomolecules—Amino acids and proteins , ionic forms of amino acids, Zwitter ion, isoelectric, pH, optical isomers of aminomacids. Formation of peptide bond – peptides—structure of polypeptides—primary, secondary, tertiary and quaternary structure of protein. Ramachandran plot - denaturation of proteins.

UNIT-IV: Lipids and Nucleic acids

Biomolecules—Lipids—structure of fatty acids and glycerol—phospholipids, glycolipids, steroids. Nucleic acids—Chemistry of nucleic acids, base pairing – denaturation and renaturation, circular and superhelical DNA, artificial synthesis of DNA, structure of Z-DNA. Structure of RNA and its synthesis.

UNIT-V: Biophysics and Enzymology

Bio-energetics—Laws of thermodynamics—entropy, enthalpy and free energy. Exergonic and endergonic reactions, Redox potential, Structure and hydrolysis of ATP, high energy compounds. Enzymes—Nomenclature, Classification and properties; Factors affecting enzyme activity—Activation energy—enzyme kinetics—Michaelis – Menton equation—enzyme inhibition—enzyme regulation. General principles of extraction and purification of enzymes. Enzyme immobilization. Application of enzymes in industry and medicine.

Biochemistry and Biophysics Practical:

1. Qualitative test for Glucose, Starch, Amino acids and Proteins.
2. Estimation of total carbohydrates by Anthrone reagent.
3. Estimation of starch by Lugol's iodine method.
4. Estimation of proteins by Lowry *et al*. method.
5. Estimation of amino acids by Ninhydrin method.
6. Estimation of Proline content.
7. Assay of enzyme Nitrate reductase/Lipase/ Ribulose Biphosphate Carboxylase.

Books:

1. Bonner, J and J.E. Varner,1976. Plant Biochemistry, Academic press, New York.
2. Casey,J.E, 1962. Biophysics(Concepts and mechanisms). Affiliated East West press.
3. Conn.E.E., P.K.Stumps, G.Brueming and R.G Dol, 1987. Outlines of Biochemistry. John Wiley. Co, New York.
4. David, M.G, 1980. Biophysical Ecology. Springer- Verlag, New York.
5. Dennis, D.T. and D.H. Turpin, 1989. Plant physiology, Biochemistry and Molecular Biology. Longman Scientific and technical publishers, U.K.
6. Elliot, W.H. and D.C. Elliot, 1997. Biochemistry and Molecular Biology. Oxford University press, New York.
7. Eugene, A, B.M Linda, Ellis and E.W. Lawrence, 1979. Biophysical Science. Prentice Hall, Inc, New Jeresy.
8. Goodwin, T.W and E.I. Mercer, 1983. Introduction to Plant Biochemistry, Pergamon, New York.
9. Hans-Walter. Headt, 1997. Plant Biochemistry and Molecular Biology. Oxford University press, New York.
10. Jain, J.L., Sunjay Jain and Nitin Jain, 2007. Fundamentals of Biochemistry, S.Chand & co New Delhi. Styer, L. 1981. Biochemistry. W.H. Freeman and company, New York. Sadasivam and Maniam, A.1992. Biochemical methods for Agricultural Sciences.
11. Mahadevan, 1962. Plant pathology.

PAPER - 12

RESEARCH METHODOLOGY

UNIT – I Research Methodology

Meaning and scope of research; Research design—Choice of the problem—Scientific writing – Characteristics, Logical format for writing thesis and papers. Essential features of abstracts. Introduction – components. Review of literature – Primary, secondary references. Materials and methods-- Effective illustration--Tables and figures, Discussions--Reference styles – Harvard and Van couver system, proof correction. Reporting the results in conference by oral /poster presentation—written reports.

UNIT – II Instruments

Priniples and application of Clinical centrifuge, High speed centrifuge, Radio active Isotopes and half life of Isotopes—Autoradiography, Scintillation counter, GM counter. Chromatography – types and uses. Electrophoresis techniques; Principle and applications of Colorimeter, UV-visible spectrophotometer and Atomic absorption spectrophotometer.

UNIT – III Basic Biostatistics

Collection of data, classification and tabulation of data—primary and secondary data. Graphical or diagrammatic representation of data. Measures of central tendency—mean, median mode, harmonic mean and geometric mean, range, standard deviation, combined mean and deviation, Standard error.

UNIT – IV: Research tools of Statistics

Probability – types, rules of probability, normal and binomial distribution. Test of significance, level of significance. ‘t’ – test, ‘F’ test, Chi-square test, ANOVA- two way, simple correlation and regression. Sampling and experimental designs of research—Randomized block design and Split plot design.

Unit – V Computer Application

Computer in biological science, scope and prospects-- – Classification-Input and output devices. Operation system- function and components. MS windows – MS-Word-folders, files, MS Excel – Data storage – Data analysis – MS Power point – creating slides – templates – animation and transitions. On line publications: Electronic journals – Email, e-access. Biostatistics packages, Data base preparation, Graphic applications in biology.

Practicals:

1. Demonstration of Microtomy technique.
2. Demonstration of column and Thin Layer Chromatography technique.
3. Demonstration of P^H meter, Colorimeter, UV-Visible Spectrophotometer, Centrifuge and Electrophoresis.
4. Tabulation, calculation and Graphical representation of Statistical data.
5. Application of Computer in the field of Biology

Books:

1. Balagurusamy, E. 1985. Programming in Basic. Tata MacGraw Hill. Pub, Co, U.K.
2. Connor and Peter Woodford, 1979. Writing Scientific paper in English. Pitman Publ. Co, U.K.
3. Deenadayalu, R. 987. Computer Science Vol I. Tata MacGraw Hill. Pub, Co, U.K.
4. Khan I.A, and A. Khanum, 1994. Fundamentals of Biostatistics. Vikas Publ Hyderabad.
5. Kothari, C.R, 1991. Rresearch Methodology—Methods and Techniques. Wiley Eastern Ltd, New Delhi.
6. Prasa, SW. 2007. Elements of Biostatistics. Rastogi publications, Meerut.
7. Rangasamy, R.A, 1995. A text book of Agricultural Statistics. New Age International publications, Chennai,
8. Scholkopf, Isuda and Vent Kernel, 2005. Methods in Computational Biology. Ane Books, New Delhi.
9. Sree Ramalu, V.S, 1988. Thesis writing. Oxford & IBH publ, New Delhi.
10. Singh, R. 2006. Research Methodology in plant science. M.J.P. Publications, New Delhi.
11. Zar, J.H, 1984. Biostatistics Analysis. Prentice Hall International, London.

ELECTIVE

PAPER – 4

(Choose either A or B or C)

A. BIOINFORMATICS

UNIT – I Introduction

Introduction and scope of bioinformatics, Introduction to computers—types of Hardware and soft ware operating systems. Internet and Intranet-world wide web-Search engines – their functions. searching – file formats, Internet protocols -telnet, ftp.

UNIT – II Biological Databases

Data management, Biological data bases and their uses. NCBI, EMBL, DDBJ, SWISSPROT, PDB etc., Data retrieval systems.

UNIT – III Sequence alignment

Sequence analysis-pair wise alignment, global & local alignment algorithms, multiple alignment-clustral W and phylip. Tools for similarity searching and sequence alignment – FASTA and BLAST. Phylogenetic analysis. Profiles and motifs.

UNIT – IV Gene and Protein structure prediction

Gene finding; Gene finder and feature detection in DNA; protein structure prediction- Primary and secondary structure; Protein structures visualizing and tools;

UNIT – V Functional Genomics and Proteomics

Computer aided drug designing. Human genome project; DNA sequence methods; SAGE; Protein sequencing; Mass spectrometry- principle of MALDI-TOF.

Books:

1. Andreas D. Baxevanis and B.F. Francis overlette, 2002. Bio-informatics, John wiley & Sons.
2. Des Higgins, Willie Taylor, 2004. Bio-informatics, Oxford university press.
3. Gibas and Jamback. 1999. Developing Bioinformatics Computer skills, O'Rielly Associates.
4. Harshishtha,D.2006. Techniques in teaching computers. International book distributor , Dehradun.
5. Ignacimuthu, S.J. 2005. Basic Bioinformatics, V.K. Mehra, Narosa publishing house.
6. Irfan alikhan, Atiya Khanum, 2003. Essentials of Bioinformatics, Ukaaz publications.
7. Rastpgo, S, N. Mendinatta and P. Rastogi. 2003. Bioinformatics- Concepts, skills and application. CBS. publication, New Delhi.

ELECTIVE

PAPER – 4
(Choose either A or B or C)

B. WOOD TECHNOLOGY

UNIT – I Features of cambium

History, scope and significance of wood technology
Cambium—development, structure, significance of cambium and their organization. Mechanism of increase in the girth of the cambium cell division, factors affecting cambial activity, indirect effects of environment on wood formation, role of water on wood formation.

UNIT – II Identification of woods

General features of wood—Colour, hardness, weight, odour, lusture and texture, Cellular composition—pores and their patterns of their distribution, growth rings, heart and sap wood, Juvenile wood and reaction wood. Minute features—Vessels—length, width, shape, lateral wall pittings, frequency of distribution per unit area, perforations, wall thickness, inclusions, intervessel pits, tyloses. Tracheids—size, wall characteristics and tyloses, Fibres—length, wall thickness, pits , types. Rays—classification and types.

UNIT – III Properties of Wood

Physical properties—density and gravity of wood. Calculation of moisture content, thermal expansion of wood, specific heat wood, Mechanical properties—Tensile strength, Comparison strength, shearing strength, bending strength, stiffness, toughness or shock resisting ability, hardness, cleavage resistance. Factors affecting mechanical properties of wood
Chemical properties—Cellulose, hemicellulose, lignin, mineral matter, essential oils, resins, tannins, dyestuffs and wood extractives. Distribution of chemical constituents in wood.
Figures in wood—Plain and quarter sawnfigure, rotary cut figure, wavy and curly figure, blister figure, quilted figure, bird's eye figure and crotch figure.

Unit – IV Defects of wood

Natural defects—knots, growth stresses (compression and tension wood) branches and spiral and diagonal grains, frost injuries, pitch pockets, bark pockets, latex canal, logging injury, and honey combing.
Defects due to seasoning—checks, warping, collapse raised grains, loose grain and weathering.
Defects due to organisms—discolouration by moulds and fungi, pitch flecks, powder post damage by marine borers.

UNIT – V Wood products

Wood products—poles, timbers, plywoods, furnitures, cooperage, wood flour, and handicrafts. Secondary products—cased lead pencils, math sticks, tooth picks, excelsior wood turnings. Chemically derived products—pulp and paper, Cellular derived products—filament and yarn cellulose, fibres and explosives and medicinal importance of wood.

Books

1. Bailey, I.W. 1954. Contributions to Plant Anatomy. Chronica Botanica Botanics, Waltham, press
2. Brown, H.P., 1949. Text book of wood technology, Vol I McGraw Hill Book Co, New York.
3. Brown, H.P., 1949. Text book of wood technology, Vol II McGraw Hill Book Co, New York.
4. Chowdry, K.A., 1958. Indian woods Vol I. Mj Publications , New Delhi
5. Gamble, J.S., 1922. A manual of Indian timbers, London
6. Jane, F.W., 1956. The structure of wood . Adams and Charles Black, London
7. Panshin, A.J., 1962. Forest products, their sources, production and utilization, McGraw Hill Book Co, New York.
8. Pearson,R.S., 1932. Commercial timbers of India. Govt. Of India Publication branch, Calcutta.Wangaard,F.F., 1949. The mechanical properties of wood. John Wiley & Sons, New York.

ELECTIVE

Paper – 4
(Choose either A or B or C)
C. Biodiversity and Conservation biology

UNIT-I: Introduction

Biodiversity – Ecosystem. Species. Genetic Agrobidiversity; Historical account of conservation of flora in India. Plants as protectors of environment.

UNIT – II : Conservation Strategies

Plant genetic resources: Endangered and threatened plant species – conservation strategies (in-situ, ex-situ and community conservation) – cause of extinction of species, red data book.

UNIT – III: Plant Biodiversity

Conservation of forest and Wild life. Biodiversity biosphere reserves, sanctuaries, sacred groves, National Parks, Coastal regulatory Zone Act, management of Mangrove vegetation. Ecological modeling- significance.

UNIT – IV: Threats to Biodiversity

Habitat degradation and fragmentation over exploitation. Invasive alien species and their impact. Climate change and its impact on Biodiversity.

UNIT – V: Management of Biodiversity

Rio Earth Summit (1992) Man and Biosphere programme, role of WWF, UNDP, and FAO in Forestry programs in India. International and National legislations and conventions on Biodiversity- CBD,. NBA, CITES and TRAFFIC.

BOOKS :

1. Khan. T.I and Shishoda. Y.S. 1998. Biodiversity Conservation and sustainable Development Pointer Publisher, Jaipur, India.
2. Trivedi. P.R. Gurdeep Raj. 1992 Environmental Wildlife and Plant. Conservation Akashdeep Publising House, New Delhi, India.
3. Agrwal. K.C. 1996. Biodiversity, Agrobotonical Publishers, India.
4. Sinha. K.R. 1996. Global Biodiversity, INA Shree Publishers, Jaipur, India.
5. Sharma. P.D. 1975. Ecology and Environment, Rastogi Publications, Meerut, India.
6. Muklharjee. B. 1997. Environmental Biology. Tata Mcgraw Hill Publishing Company Ltd., Delhi.
7. Frame. B. Victory. J and Joshy. Y. 1994. Biiodiversity Conservation: Forests. Wet lands and deserts. Tata Energy Research Institute. New Delhi, 153 pp.
8. Krishnamurthy. K.V. 2003. An advanced Text Book on Biodiversity: principles and practices. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.

Core Practical - I

(PHYCOLOGY, BRYOLOGY, MYCOLOGY, BACTERIOLOGY, LICHENOLOGY, PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY)

Time : 4 Hours
Max. Marks : 100
Practical : 50
Record : 10
Internal : 40

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1. Cut the transverse/ longitudinal sections of the given material A and B. Identify by giving reasons.
Draw labeled sketches. Submit the slide for valuation. (2 x 5 = 10)

2. Take transverse/ longitudinal sections of the given materials C, D and E stain it and mount in glycerin. Submit the slides for valuation. Identify by giving reasons. Draw labeled sketches. (3 x 5 = 15)

3. Identify the fossil slides F and G. Give reasons. Draw labeled diagrams. (2 x 4 = 8)

4. Identify the given pathological specimen H. Write the causal organism, Symptoms and control measures. Draw labeled diagrams. (1 x 5 = 5)

5. Write critical notes about the given spotters I, J, K, L, M and N. Identify and Draw label sketches.
(6 x 2 = 12)

Core Practical - I

Key

Q. NO	Material	Identification	Reason	Diagram	Slide	Total
1.	A Algae	½	2	½	2	5
	B Fungi	½	2	½	2	5
2.	C Bryophytes	½	2	½	2	5
	D Pteridophytes	½	2	½	2	5
	E Gymnosperms	½	2	½	2	5
3.	Fossil slides	Identification	Era	Reason	Diagram	Total
	F Pteridophytes	½	½	2	1	4
	G Gymnosperms	½	½	2	1	4
4.	Pathological specimen	Name of the Disease	Causal organism	Symptoms	Control measures	Total
	H	1	1	2	1	5
5.	Spotters	Identification	Reason	Diagram		
	I Algae/Fungi	½	1	½	-	2
	J Bryophytes	½	1	½	-	2
	K Pteridophytes	½	1	½	-	2
	L Gymnosperms	½	1	½	-	2
	M Lichens	½	1	½	-	2
	N Bacteria	½	1	½	-	2

Core Practical - II

(ANATOMY, EMBRYOLOGY, CELL BIOLOGY, MOLECULAR BIOLOGY, GENETICS AND PLANT BREEDING)

Time : 4 Hours
Max. Marks : 100
Practical : 50
Record : 10
Internal : 40

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1. Cut the transverse/ longitudinal section of the given material A. Identify by giving reasons. Draw labeled sketches. Submit the slide for valuation. (1 x 5 = 5)

2. Take the transverse section of the given material B. Stain it and mount in glycerin. Submit the slides for valuation. Identify by giving reasons. Draw labeled sketches of ground plan and a sector enlarged. (1 x 7 = 7)

3. Dissect and display any one developmental stage of C. Leave the slide for valuation. Draw labeled sketches. (1 x 6 = 6)

4. Make a suitable Squash preparation of D. Show any one phase of the mitosis. Draw labeled diagrams and leave the slide for valuation. (1 x 6 = 6)

5. Write the Protocol for E and describe the procedure. (1 x 5 = 5)

6. Find out the solution for the Genetics problem F. Find out the ratio. (1 x 4 = 4)

7. Work out the Genetic problem G. Find out the order of genes and the distance between them. Construct a chromosome map. (1 x 7= 7)

8. Write critical notes about the given spotters H, I, J and K. Identify and Draw labeled sketches. (4 x 2 ½ = 10)

Core Practical - II

Key

Q. NO	Material	Identification	Reason	Diagram	Slide	Total
1.	A Anatomy	1	1	1	2	5
2.	B Anatomy (Anamolous)	1	2	1	3	7
3.	C Embryology	-	-	2	4	6
4.	D Cell Biology	-	-	2	4	6
5.	E Molecular Biology	-	5 Procedure	-	-	5
6.	F Genetics					4
7.	G Genetics					7
8.	Spotters	Identification	Reason	Diagram		
	H Anatomy	½	1	1	-	2 ½
	I Embryology	½	1	1	-	2 ½
	J Cell Biology	½	1	1	-	2 ½
	K Plant breeding	½	1	1	-	2 ½

Core Practical - III

(TAXONOMY, ECONOMIC BOTANY, BIOTECHNOLOGY, GENETIC ENGINEERING, ECOLOGY AND TOXICOLOGY)

Time : 4 Hours
Max. Marks : 100
Practical : 45
Record : 10
Herbarium : 05
Internal : 40

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1. Find the Binomial of A and B using Gamble's Flora. (2 x 2 = 4)

2. Refer C and D to their respective families based on their characters and indicate their taxonomical hierarchy. (2 x 3 = 6)

3. Prepare an artificial key (Intended/Bracketed key) based on the vegetative and reproductive characters of specimens given in E, F, G, H and I. (5 x 1 = 5)

4. Spot at the site "J" and "K". Write the Family, genus and Species name and the useful part of the given spotter. (2 x 2 = 4)

5. Write the protocol for "L". (1 x 4 = 4)

6. Calculate the given parameters based on the given Quadrate "M". (1 x 8 = 8)

7. Take the transverse section of "N". Identify, draw diagrams and write notes. Submit the slide for valuation. (1 x 5 = 5)

8. Identify and write critical notes of "O", "P" and "Q". (3 x 3 = 9)

Core Practical- III

Key

Q. NO	Material	Genus		Species		Total
1	A Binomial	1		1		2
	B Binomial	1		1		2
2	Taxonomy description & Hierarchy	Characters	Diagram	Hierarchy		
	C	1	1	1		3
	D	1	1	1		3
3	Taxonomic key	Intended / Bracket key				
	E	1				1
	F	1				1
	G	1				1
	H	1				1
	I	1				1
4	Economic Botany	Family	Genus	Species	Useful part	
	J	½	½	½	½	2
	K	½	½	½	½	2
5	Biotechnology	Aim	Requirements	Procedure	Result	
	L	1	1	1	1	4
7	Ecology Quadrate	Aim & Procedure	Tabulation & Calculation	Result	Graph	
	M	3	3	1	1	8
8	Ecology	Identification	Reason	Diagram	Slide	
	N	1	1	1	2	5
9	Spotters	Identification	Reason	Diagram	-	
	O Biotechnology	1	1	1	-	3
	P Ecology	1	1	1	-	3
	Q Toxicology	1	1	1	-	3

Core Practical - IV

(Plant Physiology, Biochemistry and Research Methodology)

Time : 4 Hours
Max. Marks : 100
Practical : 65
Record : 10
Internal : 25

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1. Set up the experiment A assigned to you. Record your observations and interpret your results. (15)

2. Analyse the given biochemical content of the material B. Record your observations and interpret your results. (10)

3. Comment on the experimental set up C. (5)

4. Analyse the given problem D. Tabulate, calculate and find out the result. Draw a graph based on the results. (8)

5. Identify the given spotters E, F & G. Draw diagrams and explain its mode of operation. (3x 4 =12)

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