

<b>Annexure No.</b>	<b>25 A</b>
<b>SCAA Dated</b>	<b>29.02.2008</b>

**BHARATHIAR UNIVERSITY :: COIMBATORE – 641 046**

**REGULATIONS FOR M. Sc., PLANT BIOLOGY & PLANT BIOTECHNOLOGY  
DEGREE COURSE WITH COMPULSORY DIPLOMA IN HERBAL SCIENCE**

**Semester System  
(with effect from 2007-2008)**

**1. Eligibility for Admission to the Course**

A candidate who has passed the B.Sc. Botany / Plant Biology & Plant Biotechnology / Plant Science / Biology Degree Examinations as main subject of study of this University or an examination of some other University accepted by the syndicate as equivalent thereto shall be eligible for admission to the Master Degree of this University.

**2. Duration of the Course**

This Course of Study shall be based on Semester System. This Course shall consist of four Semesters covering a total of two Academic Years. For this purpose, each Academic Year shall be divided into two Semesters; the first and third Semesters; July to November and the second and the fourth Semesters; December to April. The Practical Examinations shall be conducted at the end of even Semester.

**3. Course of Study**

The Course of the Degree of Master of Science/Arts/Commerce shall be under the Semester System according to the Syllabus to be prescribed from time to time. This Course consists of Core Subjects and Elective Subjects. There shall be one Paper on applied Skill Oriented, subject preferably in each semester as part of the adjunct Diploma Programme.

**4. Requirement to appear for the Examinations**

- a) A candidate will be permitted to take the University Examination for any Semester, if
  - i) he/she secures not less than 75% of attendance out of the 90 instructional days during the Semester.
- b) A candidate who has secured attendance less than 75% but 65% and above shall be permitted to take the Examination on the recommendation of the Head of the Institution to condone the lack of attendance as well as on the payment of the prescribed fees to the University.
- c) A candidate who has secured attendance less than 65% but 55% and above in any Semester, has to compensate the shortage of attendance in the subsequent Semester besides, earning the required percentage of attendance in that Semester and take the Examination of both the Semester papers together at the end of the latter Semester.
- d) A candidate who has secured less than 55% of attendance in any Semester will not be permitted to take the regular Examinations and to continue the study in the subsequent Semester. He/she has to re-do the Course by rejoining the Semester in which the attendance is less than 55%.

e) A candidate who has secured less than 65% of attendance in the final Semester has to compensate his / her attendance shortage in a manner to be decided by the Head of the Department concerned after rejoining the Course.

#### **5. Restriction to take the Examinations**

a) Any candidate having arrear paper(s) shall have the option to take the Examinations in any arrear paper(s) along with the subsequent regular Semester papers.

b) Candidates who fail in any of the papers shall pass the paper(s) concerned within 5 years from the date of admission to the said Course. If they fail to do so, they shall take the Examination in the revised Text / Syllabus, if any, prescribed for the immediate next batch of candidates. If there is no change in the Text / Syllabus they shall take the Examination in that paper with the Syllabus in vogue, until there is a change in the Text or Syllabus.

In the event of removal of that paper consequent to the change of Regulations and / or Curriculum after a 5 year period, the candidates shall have to take up on equivalent paper in the revised syllabus as suggested by the chairman and fulfill the requirements as per Regulations/Curriculum for the award of the Degree.

#### **6. The Medium of Instruction and Examinations**

The medium of instruction and Examinations shall be in English.

#### **7. Submission of Record Notebooks for Practical Examinations**

Candidates taking the Practical Examinations should submit bonafide Record Note Books prescribed for the Practical Examinations. Otherwise the candidates will not be permitted to take the Practical Examinations.

#### **8. The Minimum (Pass) Marks**

A candidate shall be declared to have passed in a paper if a student obtains not less than 50% of marks in that paper. A candidate shall be declared to have passed the whole Examination if the student passes in all the papers.

#### **9. Improvement of Marks in the subjects already passed**

Candidates desirous of improving the marks secured in their first attempt shall reappear once within the subsequent Semester. The improved marks shall be considered for classification but not for ranking. If there is no improvement there shall not be any change in the original marks already awarded.

#### **10. Classification of successful candidates**

A candidate who passes all the Examinations in the first attempt within a period of two years securing 75% and above marks in the aggregated shall be declared to have passed with First Class with Distinction.

Successful candidates passing the P.G. Degree Examinations, securing 60% marks and above shall be declared to have passed the examination in First Class. All other successful candidates shall be declared to have passed the Examination in Second Class.

#### **11. Ranking**

A candidate who qualifies for the PG Degree Course passing all the Examinations in the first attempt, within the minimum period prescribed for the Course of Study from the date of admission to the Course and secures 1<sup>st</sup> or 2<sup>nd</sup> Class shall be eligible for ranking and such ranking will be confined to 10% of the total number of candidates qualified in that particular subject to a maximum of 10 ranks.

The improved marks will not be taken into consideration for ranking.

**12. Conferment of the Degree**

No candidate shall be eligible for conferment of the Degree unless he / she has undergone the prescribed Course of Study for a period of not less than four Semesters in an Institution approved of by and affiliated to the University or has been exempted there from in the manner prescribed and has passed the Examinations as have been prescribed.

**13. Evening College**

The above Regulations shall be applicable for candidates undergoing the respective Courses in the Evening Colleges also.

**14. Revision of Regulations and Curriculum**

The above Regulation and Scheme of Examinations will be in vogue without any change for a minimum period of three years from the date of approval of the Regulations. The University may revise /amend/ change the Regulations and Scheme of Examinations, if found necessary.

**15. Transitory Provision**

Candidates who have undergone the Course of Study prior to the Academic Year 2007-2008 will be permitted to take the Examinations under those Regulations for a period of four years i.e. up to and inclusive of the Examination of April 2012 thereafter they will be permitted to take the Examination only under the Regulations in force at that time.

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**COMPULSORY DIPLOMA IN HERBAL SCIENCE  
SCHEME OF EXAMINATIONS**

<b>Paper type</b>	<b>Code</b>	<b>Sem.</b>	<b>Title of the Paper</b>	<b>MAX. MARKS</b>
CORE	BOT DHS 1	I	Medicinal Plant Biodiversity & Conservation	100
CORE	BOT DHS 2	II	Phytochemistry & Instrumentation	100
CORE	BOT DHS 3	III	Pharmacognosy & Drug Production	100
CORE	BOT DHS 4	IV	Pharmacology	100

**SCHEME OF EXAMINATIONS**  
**M. Sc., PLANT BIOLOGY & PLANT BIOTECHNOLOGY**

SEM.	CODE	SUBJECT AND PAPER	UNIVERSITY Examinations	
			Duration in Hrs	Max* Marks
I	BOTAC1	Paper. I Phycology, Mycology, Bacteriology & Lichenology.	3	100
	BOTAC2	Paper. II Bryophytes, Pteridophytes & Gymnosperms.	3	100
	BOTAC3	Paper III. Genetics, Plant Breeding & Biostatistics.	3	100
	BOTAC4	Paper IV. Cell & Molecular Biology.	3	100
II	BOTAC5	Paper V. Anatomy, Embryology & Tissue Culture.	3	100
	BOTAC6	Paper VI Environmental Botany & Conservation Biology.	3	100
	BOTAE1	Paper VII. Elective – I Introduction to Bioinformatics (without Practical Examination)	3	100
	BOTAP1	Practical –I Papers I to III	3	100
	BOTAP2	Practical – II Papers IV to VI.	3	100
III	BOTAC7	Paper. VIII. Taxonomy & Biosystematics.	3	100
	BOTAC8	Paper. IX. Biotechnology & genetic Engineering		
	BOTAC9	Paper. X. Plant Physiology & Biochemistry	3	100
	BOTAE2	Paper. XI. Elective – II. (Without Practicals) Phytopathology/ Seed Technology/ Wood Science & Technology.	3 3	100 100
IV	BOTAE3	Paper XII. Elective – III. (Without Practicals) Limnology/ Modern Trends in Taxonomy / Physiological Embryology of Angiosperm.	3	100
	BOTAE4	Paper. XIII. Elective-IV. (Without Practicals) Biotechnology / Industrial Microbiology / Ethnobotany	3	100
	BOTAE5	Paper. XIV. Elective-V. (Without Practicals) Food Science & Nutrition / Horticulture / Forest Botany.	3	100
	BOTAP3	Practical. III. Papers VIII, XI & XII.	3	100
	BOTAP4	Practical IV. Papers IX ,X., XIII & XIV	3	100

\* Includes 25% continuous internal assessment marks.

BOTAC1

SEM.I

**PHYCOLOGY, MYCOLOGY, BACTERIOLOGY AND LICHENOLOGY****UNIT-I:**

Classification of Algae (Fritsch, 1945), Comparative studies of range of structure, distribution, reproduction, life cycles, phylogeny and inter relationships of Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta, Economic Importance of Algae.

**UNIT-II:**

Classification of Fungi (Alexopoulos and Mims, 1979), Range of structure, distribution, reproduction, Phylogeny and interrelationship of Myxomycetes, Oomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Host-Parasite interaction, Heterothallism and economic importance of Fungi.

**UNIT-III:**

Classification of Bacteria (Bergey, 1923), Morphology and ultra structure. Bacterial culture and cultural characteristics. Isolation and maintenance of pure culture. Growth curve of Bacterial population, Industrial uses of Bacterial-Lactic acid, Vinegar and Insulin. Reasons for inclusion of Cyanophyta under Bacteria.

**UNIT-IV:**

History of viruses, classification (Harrison et al., 1971), Structure of Virus, Double stranded DNA Viruses, Double stranded RNA Viruses, Cauliflower Mosaic virus, Wound tumor viruses, Bacteriophages-Morphology, structure and replication, Isolation and purification of Plant viruses. HIV/AIDS.

**UNIT-V:**

Classification of Lichens (Hale, 1969). Occurrence and interrelationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basidiolichens and Deuterolichens. Lichens as indicators of Pollution, Economic importance of Lichens.

**PRACTICALS:**

1. Phycology: Gloeocapsa, Lyngbya, Pediastrum, Pithophora, Bulbochaete, Nitella, Padina, Turbenaria, Batrachospermum, Ceramium, Amphiroa and Gelidium.
2. Mycology: Albugo, Saprolegnia, Phyllochora, Alternaria and Puccinia. Slide culture technique, fungal spore count using Haemocytometer.
3. Microscopical analysis of a) Spoiled food stuffs b) Spoiled vegetables c) Spoiled fruits
4. Bacteriology, Virology and Lichenology: Bacteriophage-Books / Photographs TMV Viruses-Books/ Photographs. Antibiotic disc assay.
5. Isolation of soil microbes (Bacteria and Fungi) by dilution plating method using selective media and plate counting. Gram staining. Usnea.

**REFERENCES:**

1. Bold. H.C. and H.J. Wyne (1978) Introduction to the Algal structure and reproduction, Prentice Hall, Englewood Cliffs, New Jersey.
2. Chapman. V.J and P.J. Chapman (1973). The algae. The English language book society and Macmillan.
3. Fritsch, F.E. (1935-1945). Structure and reproduction of the Algae. Vol. II III & I.
4. Smith, G.M. (1971). Cryptogamic Botany Vol. Algae and Fungi.
5. Lee, R.E. (1987), Phycology, Cambridge University, London.

6. Round, F.E. (1973), The Biology of Algae.
7. Kumar, H.D. (1988), Introductory Phycology.
8. Alexopoulos, C.J. and C.W. Mims (1985). Introductory Mycology.
9. Anisworth, S.C., Sparrow, F.E. and A.D. Sussman. The fungi and advanced treatise. Vol. I, II, III, IV A & IV B.
10. Bessey, E.A. (1950), Morphology and Taxonomy of Fungi.
11. Webster, J. (1985), Introduction to Fungi.
12. Smith, K.M. (1974), Viruses, Cambridge University Press.
13. Power, C.B. and H.F. Dagainawala. (1982), General Microbiology.
14. Michael, J. Pelczar, Jr. E.C.S. chan and N.R. Krief. (1995). Microbiology. Tata McGraw-Hill (Ed), New Delhi.
15. Singh, R.S.-Introduction to the Principles of plant pathology.
16. Mehrotra, R.S. (1985). Plant Pathology.
17. Rangaswamy, G. and Mahadevan, A. (1999). Diseases of crop plant in India 4<sup>th</sup> Edition.
18. Das Gupta M.K. (1958). Principles of Plant Pathology.
19. Hale, M.E. (1961). A Hand Book of Lichens.
20. Hale, M.E. (1970). The Biology of Lichens.

BOTAC2

SEM.I

### **BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS**

#### **UNIT-I:**

Classification of Bryophytes (Reimers-1954), Distribution, structure, reproduction and lifecycle of Marchantiales, Jungermanniales, Anthocerotales and Bryopsida. Fossil bryophytes, economic importance.

#### **UNIT-II:**

Classification of Pteridophytes (Reimers), Morphology, anatomy and reproduction of Psilophytosida, Psilotosida, Lycopsida, Sphenopsida and Pteropsida .

#### **UNIT-III:**

Phylogenetic trends-Evolution of stele, sorus evolution, heterospory and seed habit, Affinities of various classes of Pteridophytes.

#### **UNIT-IV:**

Classification of Gymnosperms (Pilger and Melchoir) General account of Pteridospermales, Cycadales, Coniferales, Bennettiales, Pentoxylales and Ginkgoales.

#### **UNIT-V:**

General account of Cordaitales, Taxales, Gnetales, Phylogenetic trends and affinities of various classes. Evolution of angiosperms.

#### **PRACTICALS:**

1. Bryophytes: *Lunularia*, *Reboulia*, *Targonia*, *Aneura*, *Sphagnum*, *Bryum*.
2. Pteridophytes: *Psilotum*, *Selaginella*, *Angiopteris*, *Osmunda*, *Dicranopteris*, *Lygodium*, *Trichomanes*, *Alsophila*, *Nephrolepis*, *Salvinia*, *Azolla*.
3. Gymnosperms: *Cupressus*, *Podocarpus*, *Araucaria*, *Pinus*, *Ephedra*.

4. Fossils: *Rhynia*, *Asteroxylon*, *Sphenophyllum*, *Ankyropteris*, *Botryopteris*, *Heterangium*, *Lagenostoma*, *Pentoxylon*, *Medulosa*, *Cycadeoidea*, *Cordaites*.

#### REFERENCES:

1. Arnold, C.D. 1947, An introduction to Palaeobotany.
2. Coulter, J.M. and C.J. Chamberlain 1917. Morphology of gymnosperms.
3. Foster, A.S. and E.R. Gifford 1959. Comparative morphology and vascular plants.
4. Parihar, N.S. 1967. An introduction to embryophytes Vol III.
5. Seward, A.C. Fossil plants.
6. Smith, G.M. Cryptogamic Botany II
7. Sporne, K.R. 1966. The morphology of Pteridophytes.
8. Sporne, K.R. 1967. The Morphology of Gymnosperms.
9. Vashishta, P.C. 1971, Botany for degree students.

BOTAC3

SEM.I

### GENETICS, PLANT BREEDING AND BIOSTATISTICS

#### UNIT-I:

Mendel's Law of inheritance-interaction of genes, quantitative inheritance, sex determination in plants, theories of sex determination. Sex linked characters-primary, secondary and permanent, non-disjunction of sex chromosomes in *Drosophila*. Sexes influenced and sex limited characters. Chromosome theory of inheritance. Gene mutation-Detection of mutation CLB Method, Muller 5 method, Biochemical mutants in Bacteria and *Neurospora*. Detection of mutation in Bacteriophages and higher plants. Molecular basis of mutation, physical and chemical mutagens and their mode of action.

#### UNIT-II:

Multiple alleles and pseudoalleles. Modern concept of genes. Fine structure of the gene IS Element-transposons. Extrachromosomal inheritance, genome of mitochondria and plastids and their role in inheritance. Uniparental inheritance in *Chlamydomonas* and *Paramecium*-Male sterility, Population genetics-gene frequencies, mutation selection, migration, genetic drift, genetics disorder of chromosomal and genic origin. Regulation of gene expression in Eukaryotes and Prokaryotes.

#### UNIT-III:

Methods of plant breeding self-fertilized, cross fertilized and vegetatively propagated plants. Breeding plants for improving yield and quality and resistant to diseases and pests. Plant breeding work in India with special reference to Rice, cotton and Sugar cane. Role of polyploidy and distant hybridization in plant improvement. Induced mutations in crop improvement.

#### UNIT-IV:

World diminishing plant resources threatened and endangered plants. Red Data Books. Plant germplasm resources-plantation, horticultural and field crops. Medicinal plants-germplasm collection and conservation. Germplasm maintenance of Rice and Sugarcane. The role of IBPGR (Rome, Italy) and NBPGR (New Delhi), in germplasm conservation, patent and intellectual properties-Rights of Plant breeders and Biotechnologists.

#### UNIT-V:

Principle and practice of statistical methods in Biological research. Population and sampling. Data collection & Representation-graph and tabulation. Measures of central tendency-mean (only arithmetic), median and mode. Measures of dispersion-mean, deviation, standard deviation and standard error. Probability of distribution (binomial, Poisson & normal). Tests of statistical significance-chi-Square test, theories of probabilities. Analysis of variance.

**PRACTICALS:**

Solving problems involving

1. Dihybrid cross
2. Interactions of factors
3. Incomplete dominance
4. Chromosome mapping from test cross data. Calculation of interference.
5. Multiple alleles and blood group inheritance
6. Sex linked inheritance
7. Quantitative inheritance
8. Population genetics
9. Calculation of gene frequencies
10. Allelomorphic pair, multiple alleles (classical blood Groups), sex linked alleles
11. Training in hybridization techniques.
12. Hi - square test.

**REFERENCES:**

1. Gardener, E.J. (1975). 5<sup>th</sup> Ed. Principles of Genetics, John Wiley, New York.
2. Gilbert, N.W. (1978). Organellar Heredity, Raven Press, New York.
3. Gupta, P.K. (1994). Genetics. Rastogi Publication, Meerut, India.
4. King, R.C. (1975). A Hand book of Genetics, Plenum Press, New York.
5. Strickboarger, M.V. (1977). Genetics, Mac Millan, New York.
6. Arnold, R.W. (1960). Principles of Plant Breeding. John Wiley & Sons, Inc, New York.
7. Sing, D.D. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
8. Swaminathan, M.S. And Jana.S (1992). Biodiversity. Mac Millan, India Press, Madras.
9. Palanichami, S. and Manokaran, M. (1994), Statistical Methods for Biologists.
10. Khan, J.D and Khanum, A. (1994), Fundamentals of Biostatistics.
11. Zar, J.K. 1984, Biostatistical analysis, Prentice-Hall International, INC, Englewood cliffs, New Jersey.

BOT AC4

SEM.I

**CELL AND MOLECULAR BIOLOGY**

**UNIT- I:**

Cell ultra structure and detailed study of cytoplasmic organelles. Cytoplasm – structure, physiochemical properties and chemical composition. Mitochondria-origin, structure and functions. Golgi apparatus-origin, structure and function. Plastids-proplastids and development of plastids, classification, morphology, structure, chemistry and functions. Structure and functions of Ribosome, Dictyosome, Lysosome, Sphaerosome, Glyoxisome and peroxisome.

**UNIT- II:**

Plasma membrane- Molecular structure, chemical nature and functions. Cell wall-primary, secondary and tertiary at microscopic, submicroscopic and molecular levels. Chemistry of cell

wall-different polysaccharides, lignin, chitin, suberin, cutin and wax. Structure and functions of nucleus, nuclear envelope and nucleolus.

### **UNIT- III:**

Chromosomes-general account only. Cell divisions: Mitosis-mitotic apparatus and its physiochemical characteristics and biochemical composition. Meiosis- process of meiosis in detail, theories on crossing over and chiasma formation and significance. Chromosomal aberration-causes autonomous and induced deficiencies, duplications, inversions (paracentric and pericentric) and translocation.

### **UNIT-IV:**

Macromolecules- Classification. Nucleic acid- physical and chemical structure of DNA, Types of DNA, Watson and crick model of DNA, viral DNA, bacterial DNA, Mitochondrial and chloroplast DNA. DNA as genetic material, DNA synthesis and replication, termination of replication, Enzymes of DNA replication, Methylation of DNA and mismatch repair.

### **UNIT-VI:**

Synthesis of RNA, different types of RNA, DNA dependent RNA, and polymerize. Initiation of transcription, post transcriptional changes in RNA, Genetic code. Working principles of Electron, Scanning, Transmission and Fluorescence Microscopy.

### **PRACTICALS:**

1. Study of mitosis and meiosis using squashes and smears.
2. Interpretation of micrographs from standard purchased materials or from transparencies.
3. Karyotyping and chromosome banding technique.

### **REFERENCES:**

1. Freifelder, D. (1983). 2<sup>nd</sup> Ed. Marosa publishing house
2. C.P. Swanson, T.Merz, W.J. Young. (1988). Cytogenetics. 2<sup>nd</sup> Ed. Prentice hall India. Pvt. Ltd.,
3. J.D. Watson and W.A. Benjamine. 3<sup>rd</sup> Ed. Molecular Biology of the genes.
4. Archana Sharma. (1985). 2<sup>nd</sup> Ed. Chromosomes. Oxoford and IBH Publishing Company.
5. Arthur korengerg, W.H.DNA Synthesis. Freeman and Company.

BOT AC5

SEM.II

## **ANATOMY, EMBRYOLOGY AND TISSUE CULTURE.**

### **UNIT – I:**

Meristems (general account, vascular cambium – origin, types, structure and etiology. Cambium in wound healing, various types of Anomalous secondary thickening (different positions and activity of cambium). Leaf ontogeny of monocots and dicots.

### **UNIT-II:**

Secondary xylem – Ontogeny, structure and function – Diffuse and porous wood growth layers, sap wood and heart wood. Arrangement of vessels in secondary xylem of Dicots. Structure of rays – types and evolution of rays. Dendrochronology – Compression wood and Tension wood. Phylogenetic trends and specialization of Primary xylem and Primary Phloem – nodals types and evolution.

**UNIT-III:**

Development of anther, physiology and etiology of anther tapetum, pollen wall morphogenesis. Pollen stigma compatibility, Megasporogenesis and female gametophyte, nutrition of the embryosac.

**UNIT-IV:**

Fertilization, control of fertilization, apomixes, parthenocarpy, etiology and physiology of endosperm Haustoria, Development of dicot and Monocot embryos and classification. Embryology in relation to taxonomy.

**UNIT-V:**

Choice of explant, inoculation, protoplast culture, somatic hybridization, meristem culture for virus free clones, cryopreservation – tissues culture in plant improvement, Role of growth promoting substances.

**PRACTICALS:**

1. **Anatomy:** Study of suitable examples to illustrate features in Anatomy theory syllabus, with the help of section, peelings and mace rations. Submission of double stained 5 hand section slides. Micrometry.
2. **Embryology:** stages in the development of microsporangium and male gametophyte. Configuration of ovules, 2,4 nucleate embryosac, mature embryosac. Types of endosperm. Stages in embryogeny globular proembryos. Mature embryos of monocot and dicot. Interpretation of embryological drawings. In vitro pollen germination.
3. **Tissues culture:** Preparation of stock solution, sterilization, inoculation, nutrient media, organ culture, Morphogenesis, Induction of callus, embryoids.

**REFERENCES:**

1. Eames, A.J and M.C.Daniel 1976. An introduction to plant Anatomy.
2. Elizabeth, G.Cutter 1978. Plant anatomy part I & II ELBS AND Eclivand Arnald Ltd.
3. Esau, K. 1977. Anatomy of seed plants. Willy
4. Esau, k. 1965. Vascular differentiation in plants. Rirehant and Winston. Inc.
5. Fahn, A. 1967. Plant anatomy Channel and Company.
6. Shewin Carlquist 1962. Comparative plant anatomy. Haif, Rein hart and Wonsten. Pandey, B.P. 1978. Plant anatomy Channel and Company.
7. Bhojwani, S.S and Bhatnagar S.P. 1978. The embryology of angiosperms – Vikas – new Delhi.
8. Johansen, D.A. 1950. Plant embryology.
9. Maheswari, P. 1950. Introduction to embryology of angiosperms McGraw Hill.
10. Maheswari, P. 1963. Recent advances in the embryology of Angiosperms.
11. Reinert Bajaj, 1977. Plant cell, Tissue & Organ culture.
12. Krube Jr. P.J. and Jr. M.K. Petterson 1973. Tissue culture methods and application.
13. Thorpe T.A. 1981. Plant tissue culture methods and application in agriculture.
14. Raghavan. V. 1976. Experimental embryogenesis in vascular plants. Academic press London.
15. Pullaiah, T., Naidu, K.C., Lakshminarayana, K. and Hanumatha Rao, B. 2007. Plant Development. Regency Publications, New Delhi.
16. Pullaiah, T., Lakshminarayana, K. and Hanumatha Rao, B. 2000. Text Book of Embryology of Angiosperms. Regency Publications, New Delhi.

BOT AC6

SEM.II

**ENVIRONMENTAL BOTANY AND CONSERVATION BIOLOGY****UNIT-I:**

History and scope of ecology, Concept of ecosystem. Synecology – Basic concept of population ecology. Modern concept of biotic community. Major and Minor communities. Methods of studying plant community.

**UNIT-II:**

Biogeochemical cycling. Reserve and cycling pattern in tropical and temperate regions. Ecological indicators.

**UNIT-III:**

Environmental pollution. Scope, sources of air, water, soil. Radiation and noise pollution-effects and control measures. Environmental management and legislation (Broad outline).

**UNIT-IV:**

Environmental education- Principles, Environmental education programmes. Environmental education in India. Environmental organization and agencies, MAB- national organization. Indian forests and wild life.

**UNIT-V:**

Conservation – Principles and applications, *ex situ* and *in situ* preservation of natural resources, strategy to demand agroforestry and social forestry, Forest conservation through laws, world conservation strategy (WCS) and national conservation strategy (NCS).

**PRACTICALS:**

1. Determination of linear changes in vegetation by using line and Belt transect methods.
2. Determination of frequency, density abundance, dominance, FICC, dominance index. Similarity index & diversity index by using quadrat frame.
3. Description of community structure by using the units, conservation and association.
4. Estimation of total biomass and herbage yield by harvest method.
5. Description of zonation in a pond and stratification in a forest
6. Soil and water
  - i. Garden soil experiment to make texture.
  - ii. Capillary water.
  - iii. Field capacity.
  - iv. Witing coefficient.
  - v. PH of the soil.
  - vi. Chemistry of the soil (NO<sub>3</sub> PO<sub>4</sub> & SO<sub>3</sub>)
  - vii. Water analysis for dissolved oxygen and carbon-di-oxide.

**REFERENCES:**

1. Ambasht, R.S. (1988). A text books of plant ecology. Students, Friends & Co., Varanasi.
2. Edward J. Kormondy, (1996). Concept of Ecology, Prentice Hill of India Pvt, Ltd. New Delhi.
3. Emil T. Charlett. Environmental protection Tata Mc graw Hill New Delhi.
4. George L. Clarke (1954). Elements of Ecology. John Wiley & sons. Inc.,
5. New york.

6. Joseph M. Moran, Micheal D. Morgan and jances H. Wiersing. Introduction to environmental science W.H. Freemar & Sam Francisco. U.S.A.
7. Misra K.C. (1980). Manual of plant ecology (second edition) Oxford and IBH Publishing Co., New Delhi.
8. Odum E.P. (1971). Fundamentals of ecology, W.B. Saunders Co., Philadephia, London.
9. Perkins H.C. (1974). Air pollution, Mc Graw Hill Kongotusta Ltd, Tokyo.
10. Robert Smith, (1977). Elements of ecology and field biology, Harper and Raw Publishers, New York, London.
11. Sharma, P.D. (1991). Ecology and Environment, Rastogi Publishers, Meerut.
12. Micheal. P. (1984). Ecological methods for field and laboratory investigations, Tata Mc Graw Hill publishing company Ltd., New Delhi.
13. Misra, R. (1986). Ecology work book, Oxford and IBH publishing company, New Delhi.
14. Mc. Coull J. Crostant (1974). Water pollution. Hancount Pracojavanocichetne, New york, Atlanta.

BOTAE 1

SEM.II

### **ELECTIVE-I. INTRODUCTION TO BIOINFORMATICS**

#### **UNIT-I:**

Introduction to concepts of Bioinformatics.

What is Bioinformatics?

History of Bioinformatics.

Applications and scope of Bioinformatics.

Computer Architectures.

Number system

Memory units

Auxillary storage devices

Input and output devices

-Key words, mouse, web camera, floppies, CD, monitors and printers.

Memory, hard disc, RAM and external memory.

#### **UNIT-II:**

Language. Windows environment and Internet.

Introduction to language

Operating systems. Windows

Windows environment; Menu bar, Task bar, system tray

Applications: Word, power point, excel

Internet; History, principles, uses and applications

HTTP,protocol, WWW.FTP. E-mail. E-groups. Browsers, search engines and searching tip.

#### **UNIT-III:**

The biological databases

What is a databases?

Type of biological databases

Sequence databases

Structural databases

Literature databases

Submission and retrieval of information through web and ftp.

**UNIT-IV:**

## Sequence Analysis

Sequence alignment

Global Vs local alignment

Substitute matrices: BLOSUM and PAM

Scoring methods

Gap introduction in the alignment gap penalties.

## Similarity searching tools

Using of sequence similarity search BLAST and FASTA

## Multiple sequence alignment and phylogenetic analysis

Impotents of multiple sequence alignment.

Multiple sequence alignment tools

Phylogenetic analysis:

Homologs, paralogs and Zenologs

Uses of cluster phylogenetic analysis.

**UNIT-V:**

## Prediction of gene function

Prediction of gene in eukaryote and prokaryotes.

Translation of gene into protein.

Protein secondary structure prediction.

Prediction of domains, motifs and profiles of proteins.

**PRACTICALS:**

1. Document files creation using MS word. Creating document style.

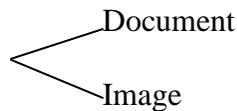
2. Internet – E-mail and mail attachment

Downloading webpage

Saving a web page

Printing the web page

Search engine



3. Visit to genebank database

NCBI

EMBL

4. Visit to protein database

Swis prot

PDb

5. Use of literature database

Virtual library

Agricola

Pub med

6. Use of similarity search tools

NBLAST

PBLAST

**REFERENCES:**

1. Bioinformatics. A practical guide to analysis of genes and proteins. 1998. Baxevanis and Quellerie.

2. Bioinformatics: A biologist's guide to biocomputing and the internet. 2000. Stuart M. Brown.

3. Bioinformatics for beginners. 2002 K.Mani and Vijayaraj.
4. Introduction to Bioinformatics. 2002. Arthur M.Lesk.
5. Introduction to Bioinformatics. 1999. T.K.Attwood and Parry-Smith.
6. Introduction to Bioinformatics. 2002. S.SundaraRajan and R.Balaji.
7. Bioinformatics: Sequence and genome analysis. 2001. David W. Mount.

BOTAC7

SEM.III

### **TAXONOMY AND BIOSYSTEMATICS**

#### **UNIT-I:**

A brief historical account of the classification of angiosperms up to the present day. Systems of classification: Detailed study of Bentham and Hooker, Engler and Prantl, Bessy, Hutchinson, Takhtajan, Cronquist – Merits and demerits. International code of Botanical Nomenclature, Typification, Principles of priority and their limitations, Effective and valid publication, citation, retention, choice and rejection of names.

#### **UNIT-II:**

Menispermaceae. Polygalaceae, Caryophyllaceae. Portulacaceae, Oxalidaceae, Tiliaceae. Combretaceae. Onagraceae, Lythraceae, Aizoaceae.

#### **UNIT-III:**

Oleaceae, Gentianaceae, Apocynaceae, Boraginaceae, Bignoniaceae, Pedaliaceae, Nyctaginaceae, Chenopodiaceae, Loranthaceae, Commelinaceae, Aroideae, Cyperaceae, Economic importance of families mentioned.

#### **UNIT-IV:**

Flora, Monograph, Keys, Botanical gardens. Source of taxonomic information, Anatomy, Embryology, Palynology, Cytology and Ultra structure and phyto chemistry.

#### **UNIT-V:**

Biosystematic- its aim and scope. Biosystematic categories, Phenotypic plasticity. Turreson's work. Population concept. Species and genus concepts, Genecology, ecological differentiation, Numerical taxonomy.

#### **PRACTICALS:**

Study of the characters of the above-mentioned families, Economic importance, Preparation of artificial key and submission of herbarium sheets – 50.

#### **REFERENCES:**

1. A classification of flowering plants Vol. I & II Rendle A.R. Cambridge University press.
2. Taxonomy of vascular plants. Lawrance.H.M. Mac Millan & Co.
3. Principles of Numerical Taxonomy. Sokal, S.R and Sneath P.H, N.H Fremmen & co.
4. New concepts in flowering plants taxonomy. Heslop. J. Herrison.
5. Plant Taxonomy – Hey wood, V.H. English hand book society
6. Principles and methods of Plant Biosystematics-solbrig. The Mac Millian Company.
7. An introduction to plant Nomenclature. S.S.R. Bennet international Book distribution India.
8. An aid to the International code of Botanical. Hentry A.N. Today & Tomorrow Pvt. Ltd.
9. Principles of angiosperm Taxonomy. Devis & Hey wood Krieger publication Co.
10. Introduction to Principles of Plant Taxonomy Sivarajan Oxford & IBH Pvt. Company.

11. A hand book of field and Herbarium methods Jain S.K. and Rao R.R. Today and Tomorrow Publications.
12. Plant Taxonomy and Biosystematics. Stace clive. A Edward Arnold.

BOTAC8

SEM.III

### **BIOTECHNOLOGY AND GENETIC ENGINEERING**

#### **UNIT-I:**

Scope and importance of Biotechnology. Tools of genetic engineering; Enzymes and cloning vectors, Recombinant DNA and gene cloning. Polymerase Chain Reaction (PCR) and Gene amplification. Isolation, sequencing and synthesis of genes.

#### **UNIT-II:**

Gene transfer methods in plants. Transgenic plants. Chloroplast and Mitochondrion engineering maps of plant genomes.

#### **UNIT-III:**

Transfer of nif genes to Eukaryotes, Genetics of Diazotrophs (Nod gene, nif gene cloning and Hup genes). Protein engineering- rationale, assumptions , steps involved, modeling and methods. Production of encapsulated seeds.

#### **UNIT-IV:**

Isolation and culturing of microorganisms for the production of organic acid (ethanol), enzyme (Alpha amylase) and antibiotics (penicillin) by microbial fermentation. Biotechnology in paper industry, biohydro- metallurgy and biomineralisation, biofertilizers, bioinsecticides and application of genetically engineered bacteria.

#### **UNIT-V:**

Current levels of biodiversity, alpha ( $\alpha$ ) and beta ( $\beta$ ) biodiversity, extinction and endangered species, steps to preserve biodiversity, in situ and ex situ conservation- gene banks, species conservation. Intellectual Property Rights (IPR), Intellectual Property Protection (IPP) and patenting of biological material.

#### **PRACTICALS:**

1. Demonstration of techniques of in vitro culture of various explants.
2. Isolation in plant protoplasts (e.g. Tobacco, Petunia) using enzyme available commercially and estimation of their yield and viability.
3. Isolation of plant genomic DNA and checking its purity (Onion).
4. Isolation of chloroplast by using column chromatography.
5. Isolation of plasmid from microbes.
6. Production of ethanol using microbes.
7. Biodegradation of paper and pulp industry effluent.
8. Absorption of metals by using microbes.
9. Culture and isolation of chemical fertilizers and pesticides removal using microbes.

**REFERENCES:**

1. Callow, J.A., Ford Lloyd, B.V. and Newbury, H.J. (1997). *Biotechnology and Plant Genetic Resources; Conservation and Use*. CAB International, Oxon, UK.
2. Dubey, R.C. (1999). *A Text Book of Biotechnology*. S. Chand & Company.
3. Glazer, A.N. and Nikaido, H. (1995). *Microbial Biotechnology*. W.H. Freeman & Company, New York, USA.
4. Gupta, P.K. (1998). *Elements of Biotechnology*. Rastogi Publication.
5. Ignachimuthu, S.(1995). *Basic biotechnology*. TaTa Mc Graw-Hill Publishing Company Ltd., Madras.
6. Kartha, K.K. (1985). *Cryopreservation of Plant cells and organs*. CRC Press, Boca Ration, Florida, USA.
7. Santharam, S. and Montgomery, J.F. (1999). *Biotechnology, Biosafety and Biodiversity*. Oxford and IBH Publishing Co., New Delhi.

BOTAC9

SEM.III

**PLANT PHYSIOLOGY AND BIOCHEMISTRY****UNIT-I:**

Water, its biological significance, water relationship of the plants, osmosis, permeability, diffusion, chemical potential, water potential, metric potential, pressure potential. A general account of absorption and translocation of water, solutes and assimilates. Transpiration and stomatal mechanism.

**UNIT-II:**

Photosynthesis, organization of thylakoids. Photosynthetic pigments and functions. An outline of chlorophyll biosynthesis. Mechanism of photosynthesis-light reaction, the two transport chains. Emersons effect, photophosphorylation, carbon fixation and glycolate metabolism and its significance.

**UNIT-III:**

Respiration-glycolysis, energy conversion stages of glycolysis, metabolism of fats and storage proteins to carbohydrates, regulation of glycolysis, and outline of pentose phosphate path way. Pyruvate metabolism, TCA cycle, electron transport system coupled with oxidative phosphorylation, inhibitors of electron transport system.

**UNIT-IV:**

Thermodynamics – Laws, enzyme as catalysts – enzyme kinetics, classification, nomenclature, properties and mechanisms of enzyme action. Biomolecules : A concise account of biomolecules-carbohydrates-classification, structure and properties of functional groups. Isomerism (only outline.)

**UNIT-V:**

Aminoacid-structure, classification, properties, isoelectric points and zwitter ions-isomerism. The concept of heterocarbon (only outline) Proteins-classification, properties primary and secondary, tertiary and quaternary, structures (only outline) Lipids-Classification, properties, saturated and unsaturated fatty acids, plant waxes and steroids (only outline).

**PRACTICALS:**

1. Determination of osmotic pressure (OP) of cell sap of given specimen (Rheo leaf)
2. Determination of diffusion pressure deficit (DPD) with potato tubers.

3. Effect of light intensity on transpiration.
4. Measurement of respiratory rate in germinating seeds and flower buds using simple respirometer.
5. Rate of photosynthesis under varying CO<sub>2</sub> conc. in a water plant.
6. Effect of intensity of light O<sub>2</sub> evolution during photosynthesis using Willmot's bubble counter.
7. Determination of water absorption/transpiration ratio.
8. Measurement of respiration by a simple respirometer or winklers method.
9. Determination of transpiration rate using simple photometer.
10. Calculation of stomatal index of upper and lower epidermal peelings of Moringa.
11. Effect of pH and temperature on the enzyme activity of the following
  - a) Peroxydase, b) Amylase, c) Catalase.

#### **Demonstration experiments:**

##### **a) Physiology**

1. Nitrification in soil.
2. Effect of GA and amylase activity in cereals
3. Effect of IAA and IBA on excised shoot/hypocotyls cuttings of legumes.
4. Hydrolysis of starch by amylase.
5. Demonstration of Hill reaction by isolated chloroplast.
6. Sand/water culture experiments to determine essentiality of minerals
7. Manometric determination of R.Q
8. Effect of ABA on stomatal opening and closing mechanism

##### **b) Bio-Chemistry - Practicals**

1. pH: operation of pH meter to measure the pH of expressed cell sap and soil solutions.
2. Buffers: preparation of phosphate buffer and citrate buffer
3. Chromatography:
  - I. Paper chromatographic technique to separate sugars, aminoacids, chloroplast pigments
  - II. Thin layer chromatographic technique to separate chloroplast sugars and lipids
4. Determination of absorption spectra of chlorophyll a and b with spectrophotometer.

#### **Demonstrations**

1. Calorimetric/spectrophotometric estimation of the following biomolecules:
  - ii) total free aminoacids (ninhydrin reagent method)
  - iii) proteins (Biuret and Lowry et al 1951v method)
  - iv) Total soluble carbohydrates (Anthrone reagent method)
  - v) Starch (Clegg's 1956, method)
3. Demonstration of electrophoresis.

#### **REFERENCES:**

1. Frank. B. Salisbury and cleon Wross.. Plant Physiology CBS publishers and distributors, New delhi.
2. Malcolm S. Wilklins. Advanced Plant Physiology.
3. Pushit., S.S., Hormonal regulation of plant growth and development.
4. Sltyar, R.G Plant water relationships.
5. Roy, G.Nogge and George J. Fritlz., Introductory Plant physiology.
6. Mayer and Anderson. Plant physiology.
7. Robert M. Devlin and Francis V. Witham Plant physiology.
8. Devlin, R.M. plant Physiology.
9. Devlin and Barker, 1973 Photosynthesis. Reinholod affiliated east west press Pvt, Ltd, New Delhi.

BOTAE2

SEM.III

**ELECTIVE – II. PHYTOPATHOLOGY****UNIT-I:**

Plant pathology; its scope and relationships to other sciences. Concept of plant diseases; saprophytes and parasitism (heterotrophic organisms and mode of nutrition), pathogenicity. Classification of plant diseases plant diseases control. Principles and methods. Legislative methods, cultural methods, soil and sand treatment, biological, control, chemical control, Control through resistant varieties, quarantine. Plant disease forecasting.

**UNIT-II:**

Symptoms, causal organism, disease cycle and control of pathogenic diseases caused by pathogenic fungi with special reference to the following diseases. Club root of crucifers, Black wart of potato, Powdery mildews wheat, Brown spot of Rice, Early blight of Potato, Angular leaf spot and Black arm of Cotton, Bacterial blight of Paddy, Sandal spike. Grassy shoot disease of Sugarcane.

**UNIT-III:**

Pathogenesis penetration and entry, colonization of the host, factors affecting in infection, enzymes in plant diseases – cell wall degrading enzyme. Toxins in relation to plant diseases: a general account, mode of action and types.

**UNIT-IV:**

Plant responses to post infectious agents; alteration in growth photosynthesis, respiration, nitrogen metabolism, aromatic compounds, and growth regulators-vascular transport.

**UNIT V:**

Defence mechanism; Genetics of plant-pathogen interaction. Effect of environment on Diseases development. Plant diseases, epidemiology, forms of epidemics and conditions governing some of the important crop diseases.

**PRACTICALS:**

1. Anatomical studies of infected regions.
2. Rhizosphere and rhizoplane studies.
3. Analysis of exudates
4. Enzymes assay in infected plants.
5. Comparison between infected and uninfected plants with reference total carbohydrate and protein.
6. Respiratory changes in infected and uninfected plants.(Demonstration only).
7. Estimation of total chlorophyll in infected and healthy plants.
8. Effect of chemicals in control of diseases.
9. Laboratory testing of the efficacy of common fungicides.
10. Biological control - methods like Tobacco leaf extracts, turmeric, neem oil, pungam oil etc.,

**REFERENCES:**

1. Agrios, Gergon, n 1988, Plant pathology academic press London.
2. Anega, KG, 1993, Experiments in microbiology, plant pathology, and tissue culture. Wishwz prakasam (willey esternlimited).

3. Boicer, F and Cook RJ 1974 Biological control of plant pathogens, Sanfrancisco.
4. Braual NK and others 1980, Text book of plant pathology. Oxford publishing company New Delhi.
5. Bilgrani, KG and Dubey HC 1980 a Text book of modern plant pathology.
6. Butler EJ Jones 1986 Plant pathology periodical book agency, Delhi.
7. Ganulco HC and KAR, AK 1986 College botany volume 11. central book depot, Calcutta.
8. Holliday, P, 1980 Fungal diseases of tropical crops. Cambridge University.
9. Manners JG 1982 Principles of plant pathology Cambridge University Press Cambridge.
10. Mehrotra, RS 1979, Plant pathology 2<sup>nd</sup> Edition. Tata McGraw hill Publi. New Delhi.
11. Manibushanrao K (ed) 1994 Recent advancement in the biocontrol of plant pathogens.
12. Puthak vn 1984 Laboratory manual of the plant Pathology, 2<sup>nd</sup>. Oxford and Ibh Publishing company, New Delhi.

BOT AE2

SEM.III

### **ELECTIVE – II. SEED TECHNOLOGY**

#### **UNIT – I:**

Scope of seed biology – Exomorphic structure of seeds – structure of dicot and monocot seeds grains. Anatomy of seed coats of Malvaceae and Leguminosae members. Albuminous (Endospermic) and non-albuminous (non-endospermic) seeds-role of caruncle, micropyle and raphe in seeds.

#### **UNIT – II:**

Chemical composition of rice, wheat. And ragi-chemical composition of green gram, black gram, chick pea and pigeon pea- chemical composition of peanut (Ground nut) and sesame(Gingili).

#### **UNIT – III:**

Physiology of seed/ grain development-phases of growth and growth curves- role of flag leaf in grain-filling and role of pericarp and seed coats in seed development.

#### **UNIT – IV:**

Synthesis and accumulation of starches in developing cereal grains- synthesis and accumulation of proteins in developing legume seeds- synthesis and accumulation of fatty acids, lipids/ oils in developing oily seeds.

#### **UNIT – V:**

Physiology of seed dormancy and germination, types of seed dormancy; physical and chemical methods to overcome seed dormancy. Physiology of seed germination- role of hydrolytic enzymes in degradation of starches, storage protein and lipids/oils in storage organs/Tissue and translocation of hydrolysed products to the developing embryonal Axis- role of phytohormones in regulation of the synthesis and, activity of hydrolytic enzymes.

**PRACTICALS:**

1. Anatomical studies of seed coat in members of Malvaceae and Fabaceae.
2. Study of seed viability by tetrazolium chloride method.
3. Seed of seed viability permeability test (in at least two samples) stored for different periods of time.
4. Determination of electrical conductivity of leachates.
5. Extraction and estimation of
  - (a). Total soluble carbohydrates by anthrone reagent method.
  - (b). Total free amino acids by ninhydrin reagent method.
6. Seed quality evaluation by starch- agar- iodine assay method.
7. Simple assay for L-amylase from germinating seeds of wheat or paddy.
8. Simple assay for protease from germinating green gram or pea seeds.
9. Simple assay for lipase from germinating seeds or castor bean.
10. Effect of thermic changes magnetism and electric shock on seed germination.

**REFERENCES:**

1. Bewley, J.D and M. Black (1978). Seed biology Vol. I & II Academic press, New York.
2. Bewley, J.D and M. Black (1985). (Eds.) Seeds; Physiology of development and germination plenum Press: New York.
3. Murray, D.R. (1984). (Ed.) Seed physiology Vol I & II Academic Press: Sydney – New York- London.
4. Khan, A.A. (Latest edition),(Ed) The physiology and biochemistry of seed Dormancy and germination. North-Holland Publishing company: Amsterdam- New York- Oxford.
5. Metha S.L. Lodha, M.L. and Sane P.V. (1993). (Eds.) Recent advances in Plant Biochemistry. Publication and information division ICAR, New Delhi.
6. Well J.H. (1990). ( Ed.) General Biochemistry Wiley Eastern Limited, New Delhi.
7. D.K. Salunkhe. Kadam S.S and Chavan J.K. (1985) (Eds.) Post harvest Biotechnology of food legumes. CRC Press, Boca Raton, Florida USA.
8. Salunke D.K. Chavan J.K. and Kadam S.S., (1985) (Eds.) CRC Press, Boca raton. Florida. Post harvest biotechnology of cereals. USA.
9. Arora S.K. (1982). (Eds.) Chemistry and biochemistry of food legumes. Oxford and IBH publication New Delhi.
10. Norton, (1976). (Eds.) Plant proteins butlerworths – London Boston.
11. Dausant.J. Mosse.J. and Vaughan, J. (1983). (Eds.) Seed proteins Academic Press., New York, USA.
12. Summerfield R.J. and Bunting A.H. (1980). (Eds.) Advances in legume science, Kew Richmond, Surrey, UK. Royal Botanic Gardens.
13. Dure L.S. (1975). Seed formation. Ann.Rev.Plant Physiol 26: 259 – 78.
14. Murray D.R. (1987). Nutritive role of seed coats in developing legume seeds. Amer. J. Bot. 74: 1122 – 1137.
15. Stump P.K. and conn E.E. (1981). (Eds.) The biochemistry of plant vol. 6 Academic Press, New York.
16. Higgins T.J.V. (1984). Synthesis and regulation of major proteins in seeds. Ann Rev. Plant physio. 35: 191 – 21.
17. Bryant J.A.(1985). Seed Physiology. Edward Arnold London.

BOTAE2

SEM – III

**ELECTIVE – II. WOOD SCIENCE AND TECHNOLOGY****UNIT – I:**

The concept of wood-Evaluation of wood in the geological past, relationship between vascular cambium and wood. The vascular Cambium-Independent evolutionary origin of vascular cambium in the different groups of vascular plants.

**UNIT – II:**

Origin of vascular cambium in the plant body-Composition of vascular cambial tissue. Light and electron microscope structure and histochemistry of fusiform and ray initials. Loss of ray initials and – Loss of ray initials and ray lessness – Stratified and non-stratified types. Cell division types and their significance – Cambial activity model for cambial activity seasonal periodically and the accompanying cytological changes- Factors affecting and determining dormancy and reactivation, differentiation of wood and wood form cambial derivatives.

**UNIT – III:**

Composition and cell types of wood – microstructure of cell wall – Wood cell types and their structure chemical and distribution variations (vessel elements, tracheids, fibres, axile parenchyma, ray parenchyma idioblasts, secretory systems), microscope structure and their value in taxonomy and physiology.

**UNIT – IV:**

Growth rings, annual rings, dendrochronology. Early wood and late wood, soft wood and hard wood, pycnoxylic and manoxylic wood, sap wood and heart wood-Heart wood structure and chemistry – Sapwood to heart wood transition and theories explaining the transition. Tyloses. Defects of wood in standing trees, reaction wood, compression and tension woods, structure, chemistry and inductive causes. Flecks, knots, wood rot, and defect of lumber, defects due to seasoning.

**UNIT – V:**

An elementary account of the physiological, chemical and mechanical properties of wood. A brief account on seasoning of wood. Major uses of wood and wood products, timber, fuel wood, pulp and paper making, plywood, veneer, chip wood, particle wood and wood extractives.

**PRACTICALS:**

Preparation of hand sections, replicas of surfaces, macerations and clearings.

1. Temporary and permanent mounting of whole specimens and sections using different types of mount ants.
2. Calibration of microscope and micrometry.
3. Microtomy and microtome sectioning.
4. Examination of different cell and tissue types with the help of techniques mentioned above.
5. Structure of (primary and/or secondary) leaf, root, stem, and floral parts (including fruits).
6. Examination of vascular cambium and study of its activity.
7. Examination of structural features and identification of wood of some common Indian timbers such as *Prunus*, *Mangifera*, *Terminalia*, Teak, Mahogany, Neem, *Lagerstroemia* and *Pterocarpus*.

**REFERENCES:**

1. Kollmann and cote 1988. Wood science and phenology I and II Springer verdiag.
2. Mohammed Iqbal Ed. 1991 Vascular cambium. Chapman and Hall.
3. Mohammed Iqbal Ed. 1994. Growth patterns in vascular plants. Dioscorides press. U.S.A.
4. Pearson and Brown. Commercial timbers of India. Government of India publications.
5. Vaus H.J Eds. 1949 and 1952. Textbook of wood technology. Vols II. MCGRAW HILL BOOK COMPANY INC. New York and I.

BOT AE3

SEM.IV

### **ELECTIVE – III. LIMNOLOGY**

#### **UNIT-1**

Definition, facts of limnology, scope and importance of limnology. The structure of fresh water aquatic system – lentic- lakes, their distribution, origin and forms. Morphology, Zonation, physical, chemical and biological structure, water shed. Ponds – swamps and estuaries, Lotic-streams, springs and rivers – discharge, temperature, nutrients, biotic categories and draft.

#### **UNIT-II:**

Physical, factors influencing lotic and lentic type of vegetation, light, heat, water movements. Chemical factors – oxygen, carbondioxide, nitrogen, phosphorus and other nutrients, alkalinity and pH.

#### **UNIT-III**

Water pollution and eutrophication-efficient water, nature, treatment and uses. Fresh water formation and flora of India, conservation and management of freshwater bodies.

#### **UNIT-IV:**

Freshwater formation, planktonic communities- phyto and Zoo planktons, littoral communities. Algae and Zoo planktons, large plants, Benthos formation organism- a knowledge of the adaptations of the above mentioned formations.

#### **UNIT-V:**

Ecosystems, energy flow in an ecosystem and community metabolism. Productivity-primary. Biomass and efficiency of primary production, secondary production. Biomass and efficiency. Gross and net productivity.

#### **PRACTICALS:**

1. Study of morphological and anatomical character of suitable representatives from local aquatic flora.
2. Phytoplankton study from different water sources.
3. Physical analysis of temperature and transparency.
4. Chemical analysis – Estimation of dissolved oxygen carbon dioxide. Total alkalinity. Total hardness and pH.
5. Gross and net productivity in plants, chlorophyll estimation.

#### **REFERENCE:**

1. Limnology. Charles R. Goldmn, Alexander, Jorne. International students edition.
2. Limnology Wetzel. Saunders college publishing Co.
3. The text book of limnology. Cole. The C.V Morby Company.

BOT AE3

SEM.IV

**ELECTIVE – III. MODERN TRENDS IN TAXONOMY****UNIT – I:**

The aims and functions of taxonomy. The historical development and different kinds of classification in the light of the following: a) Classification based on the habit (Theophrastus, Andrea Caesalpine, Bauhin, Joseph Piton, de Torunefort, John ray). B) Classification based on sexes (Carolus Linnaeus). C) Classification based on form relationships (Jean Bauhin, de Lamarck, de Jussieu, de Candolle, Bentham and Hooker). D) Classification based on presumed phylogeny (Engler and Prantl, Charles E. Bessey, John Hutchinson, A.L Takhtajan, Cronquist).

**UNIT-II:**

Herbarium and its potential role-in teaching and research: Field studies, curating and management techniques, identification and keys. Important articles of the International code of botanical nomenclature governing a) type concept, b) principles of priority, c) effective and valid publication, d) author citation, e) rejection and choice of names. F) homonym, synonym and tautonym.

**UNIT-III:**

Modern trends in taxonomy: a) comparative anatomy, b) Chemotaxonomy; c) taxonometrics. d) biosystematics. e) palynology, f) comparative embryology, g) population and the environment (Turesson's experiment, pattern of ecotype variation, evolutionary significance of the breeding system).

**UNIT-IV:**

Studies of the following selected families: Berberidaceae, Papaveraceae, Ternstroeniaceae, Moringaceae, Rosaceae, Saxifragaceae, Droseraceae, Melastromaceae, Caprifoliaceae, Sanotaceae (Ebenaceae).

**UNIT-V:**

Aristolochiaceae, Piperaceae, Lauraceae, Santalaceae, Marantaceae, Liliaceae. Aponogetonaceae. Potamogetonaceae. Eriocaulaceae.

**PRACTICALS:**

1. Study of the examples for the families included in theory syllabus the families prescribed for M.Sc (general) and B.Sc are also included for the theory and practical examination.
2. Herbarium 50 sheets for study and submission.
3. Preparation of keys-indentured and bracket types.
4. Training to solve nomenclatural problems.

BOTAE3

SEM IV

**ELECTIVE -III. PHYSIOLOGICAL EMBRYOLOGY OF  
ANGIOSPERMS**

**UNIT – I:**

Anther and pollen – morphology, cytology and physiology of tapetum, pollen wall formation, pollen analysis, physiology of pollen and germinability, pollen sterility. Anther and pollen culture and their importance in plant breeding.

**UNIT – II:**

Female gametophytes- Ultra structure of components, synergid and antipodal haustoria, nutrition of embryo sac, fertilization.

**UNIT – III:**

Embryo-embryogenic types, structure, cytology and function of suspensor, physiological and morphological relationship of endosperm and embryo, Embryo culture, Apomixis and polyembryony.

**UNIT – IV**

Endosperm- types, endosperm haustoria, their extension and persistence, function, storage metabolites, endosperm culture.

**UNIT – V**

Fruit- development, role of growth substances, parthenocarpy. Scope of embryology present and future status- Embryology in relation to phylogeny.

**PRACTICALS:**

1. Types of anther tapetum.
2. Pollen analysis – gross morphology of pollen.
3. Study of seed appendages from dissections.
4. Pollen germinability and growth.
5. Pollen germination on stigma-Maceration.
6. Dissection of embryos.
7. Methods to induce parthenocarpy.

(Candidates should also have the knowledge of the respective paper in M.Sc ., (general) level in practicals).

**REFERENCES:**

1. Austin 1968. Fertilization, Practice Hall of India, New Delhi.
2. Bhojwani S. S and S. P Bhatnagar 1985. The embryology of angiosperms – Vikas publishing House Pvt Ltd. New Delhi.
3. Davis. B 1966 systematic embryology of angiosperms.
4. Johri. B. M 1984 Systematic embryology of angiosperms.
5. Johri. B.M 1982. Experimental embryology of vascular plants. Narasu publications house, New Delhi.
6. Maheswari. P. 1958. Introduction to the embryology of angiosperms Mc Graw Hill Book Co Inc., New York.
7. Maheswari. P. and M. S. Rangaswamy (ed) 1963. Plant tissue and organ culture. International Sc. Plant morphogenesis. Delhi.
8. Raghavan V. 1976. Experimental embryogenesis in vascular plants. Academic press, London.
9. Shivanna, K. R. and B. M Johri. 1985. The angiosperm pollen structure and function. Wiley-Eastern Ltd.

BOTAE4

SEM.IV

**BIOTECHNOLOGY****UNIT I:**

Concept and scope of biotechnology: Plant tissue culture for clonal multiplication (Meristem culture and somatic embryoids) and for generation variability (by somoclonal variation and selection pressure); anther and pollen culture; selection of mutants in vitro autotrophs, disease resistance; salt and drought tolerance, nutritional quality, herbicide resistance.

**UNIT II:**

Protoplast culture and somatic hybridization, isolation of protoplast; culture and fusion method; selection of fusion product; production of cybrids and hybrids. Biotransformation and production of useful compounds through cell culture and factors affecting yield. Immobilized cell systems; bioreactors-perspectives.

**UNIT III:**

Methods for recombinant DNA technology; isolation and purification of DNA; restricted endo nucleases, enzyme digestion, agarose gel electrophoresis; pulsed gel electrophoresis; Southern/ Northern/ Western blotting; DNA sequencing; selection and screening of recombinant clones.

**UNIT IV:**

Cloning vehicles-salient features; plasmids; cosmids. Single stranded DNA viruses. Ti plasmids; Mv; construction of plasmid vectors; lambda phage vectors; M13 vectors; their uses in cloning and sequencing; expression vectors.

**UNIT V:**

Cloning strategies-genomic libraries; c DNA libraries; cloning into plant cells. Transgenic and transgenic plants. Application of recombinant DNA technology in plant improvement. Legal, social and ethical aspects of biotechnology.

**PRACTICALS:**

1. Selecting salt tolerance amino acid analog resistance through cell cultures.
2. Isolation and cultures of protoplasts.
3. Biotransformation of cellulose and production of ethanol.
4. Genetic colonization and tumor induction with Agrobacterium Ti plasmid.
5. Isolation of plant DNA, plasmid DNA and Bacteriophage DNA.
6. Restriction analysis by high molecular weight DNA.

**REFERENCE:**

1. Bhojwani S.S and Razdan M.K., 1983-Plant tissue culture: Theory and practice. Elsevier Science Publishers, Netherlands.
2. Borowitzka M.A and Borowitzka L.J.(Edu), 1988 – Microalgal Biotechnology. Cambridge University Press, Cambridge.
3. Brown, T.A, 1990 Gene cloning – an introduction – Chapman and Hall, London.
4. Conger, B.V.1981 – Cloning of Agricultural plants via in Vitro technology, CRC Press.
5. Doddes J.H. and Roberts L.E, 1985 – Experiments in plant tissue culture – Cambridge University Press, Cambridge.
6. University Press, Cambridge.
7. Brierson, D and covey, S.N 1988. – Plant Molecular Biology 2<sup>nd</sup> Edition – Blackie, Glasgow and London.
8. Giasgow and London.

9. Ignachimuthu S, 1995 – Basic Biotechnology Tata McGraw – Hill Publishing Company Ltd., Madras.
10. Johri B.M.1982 – Experimental Embryology of vascular plants Narosa Publishing House, New Delhi Springer – Verlag, Berlin.
11. Kalyan kumar D.E. 1992 – An introduction to plant tissue culture, New Central Book Agency, Calcutta.
12. Militon Zaitlin, Peter Dey and Alexander Hollonender, 1985 – Biotechnology in plant science – Relevance to agriculture in Eighties, Academic Press, Inc.
13. Natesh, S.Chopra, V.L, and Ramachandran, S. 1992 – Biotechnology in agriculture. Oxford and IBH Publishing Co., Pvt.Ltd., New Delhi.
14. Old, R.W, and Primrose, S.B – Principles of Gene Manipulation An introduction to Genetic Engineering, 4<sup>th</sup> Edition. Blackwell Scientific Publications. London.
15. Primrose, S.B. 1987 – Modern Biotechnology, Blackwell Scientific Publications.
16. Reinert, J. and B.jaj, Y.P.S. 1977 – Plant cell tissue and organ culture. Springer verlage, Berlin.
17. Reinert, J. and Yeoman M.M 1982 – Plant cell ands tissue culture A Laboratory manual. Narosa publishing house, New Delhi.
18. Razdan M.K. 1993 – An introduction to plant tissue culture - Oxford and IBH Publishing Co., New Delhi.
19. Smith, J.E. 1998 – Biotechnology – 2<sup>nd</sup> Edition. Edward Arnold, London.
20. Vasil, I.K., 1986 – Cell culture and somatic cell genetics of plants – 3 volumes. Academic Press, Inc.

BOTAE4

SEM.IV

### **INDUSTRIAL MICROBIOLOGY**

#### **UNIT I:**

History and scope of industrial microbiology, concepts, characterization and classification of micro organisms, importance of microbial enzymes in industry – commercial microbial enzymes – methods of industrial production of enzymes. Manufacture of vitamins like riboflavin and vitamin B.

#### **UNIT II:**

Fermentation techniques – products of microbial metabolism – SCP – Use of microbes in textile and cottage industries, cellulolytic and pectolytic enzymes obtained from microbes. Microbiology of soil and water, rhizosphere and mycorrhizae.

#### **UNIT- III:**

Development of industrial fermentation process, screening, detection and assay of fermentation products, stock culture, fermentation.. Media, industrial preparation, scale up of fermentation down stream process, Biological waste treatment.

#### **UNIT-IV:**

Source of important antibiotics, their chemistry and efficacy in controlling diseases of human beings and plants, industrial production of amino acids, organic acids, lactic acid, citric and acid and glutamic acid, manufacture of vinegar by microbial oxidation transformations.

**UNIT-V:**

Petroleum microbiology-petroleum formation, petroleum recovery, oil spills. Deterioration of materials – paper, textiles, and cordage. Painted surfaces prevention of microbial deterioration, immobilized cell technology.

**PRACTICALS:**

1. Media preparation – solid, liquid
2. Isolation and identification of bacteria, yeast and fungi from different sources.
3. Inoculation of fungi and bacteria on selected media and maintenance of cultures.
4. Hanging drops differential staining.
5. Isolation and identification of different types of fungi and bacteria from curd, rotten fruits and vegetables.
6. Soil microbiology – dilution and plating – estimation of microbial content of the soil.
7. Preparation of spawn for cultivation of edible mushrooms.
8. Micrometry.

**REFERENCE:**

1. Casida, IC, 1968. Industrial microbiology Wiley Eastern Ltd.
2. Chahal D.S. 1991. Food feed and fuel from Biomass, IBH. New Delhi.
3. Paul. A. Ketchum 1968. Micro biology, John Wiley & Sons USA.
4. Pelezer M.J.(Jr)., Chan, E.C.S. and Kreig, N.R, 1993. Microbiology 3<sup>rd</sup> Edn. Tata McGraw Hill, New Delhi.
5. Stanier, Dounduroff and Adelbergi – General Microbiology.
6. Alexander, M – Soil Microbiology.
7. Frobischer – Microbiology.

BOTAE4

SEM.IV

**ETHNOBOTANY****UNIT I:**

Ethnobotany – definition, its significance within the limits of the state, the nation and the conservation of rare heritage from global point of view. The loss to mankind, if the heritage is not preserved and researched by present generation. Landmarks in history of ethnobiology – relation between geology, phyto geography and ethnobotany.

**UNIT II:**

indigenous societies and interaction with plants - a global view. Relationship between man and plants – for benefit of both and developmental strategies of both. Relationship between man and plants – mutually destructive approaches.

**UNIT III:**

Linkage of Ethnobotany with other sciences and disciplines in biology – food and nutrition, medicine, sociological and cultural practices, religions and social costumes and economic relations, archaeology, history and politics.

**UNIT IV:**

Major tribes of South India and their ethnobotanical and ethno-biological heritage – Parayar, Kurichiar, Paniyar, Mulla, Karuman, Kanikkars, Naikas, Shola Naikas, Thodas, Kothas, Kurumbas, Irullas, Kattu Naikas.

**UNIT V:**

Ethnobotany and conservation of plants with special reference to India – mythology and conservation of ecosystems, conservation of selected plant species: sacred groves, forestry and unique ecosystems and their ethnobiological values, plants and animals in art, tradition and ethnography: methodologies in ethno-botanical research.

**PRACTICALS:**

1. Collection and identification of 100 plant specimens of ethno-botanical importance in South India.
2. Knowledge of making use of 20 plants – parts of the above 100 for various medicinal purposes. The mode of application, the efficiency and superstitions, if any, associated with them. The student may prepare a case study report, preferably, by direct contact with the Tribe or the community concerned who are known to possess with the knowledge of the same.
3. Visit to sacred grove or sacred forest or a particular ecosystem to prepare a field report on the ecosystem.
4. Collection and identification of ethnobotanical specimen – preparations of the following categories (4 each) – oils, medicines for asthma, skin diseases, diarrhea, family planning, and snake bite.

**REFERENCES:**

1. "Ethnobiology in human welfare: - abstracts published symposium volume under print – IV international Congress of Ethnobiology – 1994. organized by society of Ethnobotanists, national botanical research institute, Lucknow – 226001.
2. Ariyar, Yegna Narayana A.K. 1980. "Field crops of India", Bangalore – Printing and Publishing company – Bangalore.
3. CSIR 1948 – 76. The wealth of India. XI volumes.
4. Murthy A.V.S & N.S. Subramanian, 1989. "The Book of economic botany" Wiley Easterns, New Delhi.
5. Krishna Iyer L.A. 1987. "The travancore Tribes and Casts, Government Press, Travancrum.
6. Manilal K.S. 1990. "Linkages of ethnobotany with other sciences and disciplines", ethnobotany 1(1):14-23.
7. Sivarajan V.V. and Indira Balachandran. 1994. "Ayurvedic drugs and their plant sources", Oxford – IBH, Bangalore.
8. Manilal K.S. 1981. "Hortus malabaricum, Indian ethnobotany and Carmelite Missionaries", in The Christian heritage of Kerela, Ed. K.J ohn, Fr.G.
9. Burkil I.H. 1965. "Chapters on the history and botany in India". Botanical Survey of India, Calcutta.
10. Jain. S.K. (Ed).....Glimces of Ethnobotany.

BOTAE5

SEM.IV

**FOOD SCIENCE AND NUTRITION****UNIT I:**

Different food groups and planning diets to meet the requirements at different socio economic levels. Recommended allowances for Indians – basis for requirement, computation of the allowances, comparison of Indian recommended allowances with that of FAD/WHO standards.

**UNIT II:**

Pulses, grams, dhal and nuts, processing, composition, methods of cooking. Effect of processing such as soaking, roasting, germination and fermentation.

**UNIT III:**

Nutritional importance of carbohydrates, proteins, lipids, minerals and vitamins. Role of dietary fiber – digestion and utilization, protein, energy malnutrition, iron malnutrition. Strategies for combating malnutrition (role of novel protein and vegetable protein mixtures).

**UNIT IV:**

Proteins and lipids, amino acid requirements, and amino acid pattern, essential amino acids and fatty acids. Indices of protein quality evaluation, role of essential fatty acids in the body effects of deficiency and excess of fat, role of fats in the etiology of atherosclerosis.

**UNIT V:**

Naturally occurring food toxicants, protease inhibitors, haemoagglutinins, cyanogens, saponins, lathyragens, allergens and toxic amino acids and naturally occurring carcinogen – their physiological role and prevention of toxicity.

**PRACTICALS:**

1. Extraction and estimation of starch from starchy food grains;
2. Extraction and estimation of soluble proteins from pulses;
3. Extraction and estimation of crude lipids from oil-rich food grains;
4. Extraction and estimation of crude fiber;
5. Extraction and estimation of niacin;
6. Extraction and estimation of ascorbic acid.

**REFERENCE:**

1. Devadas R.P.1972. Nutrition in Tamil Nadu, Sangam publishers.
2. Jalliffe D.B. 1966 Assessment of the nutritional status of the community, WHO, Geneva.
3. MO. Laren, 1979. Nutrition in the community.
4. Dietrich Knorr, 1987. Food biotechnology. Marcel Dekker Inc. New York.
5. Jose M.Conon, 1988. Food toxicology- part A. Principles and concepts. Marcel Dekkar Inc, New York.
6. Biochemical toxicology of Environment agents. A De Brain 1976. Elsevier, North Holland, Biomedical press, pp 1-302.
7. Potter N.M.1979. Food Science. The AVI Pub., Co., Inc., West post, Connecticut, U.S.A.
8. Fox B.A. and Camerson S.G.1978. Food science – A chemical approach Second edition. University of London press Ltd.
9. Davidson, S., Pass mere, P., Brock, J.F. & Truwell 1975. human nutrition and dietetics. The English language Book society and Churchill, Livingston.
10. Swaminathan M.S 1974. Essential of Food and Nutrition Vol.I & II. Ganesh & Co. Madras.
11. Howa P. S. 1971. Basic nutrition in health and disease. W.B. Sandres Company, Philadelphia, London. Toronto.
12. Williams S.R. 1973. Nutrition and diet theory. The C.V. Mosby Co., Saint Louis U.S.A
13. Antia F.P. 1973. Clinical dietetics and nutrition, Oxford University Press, New Delhi.
14. Gopalan, C. Balasubramanian S. C. Harnsasastri B.V. and Viswaswars Rao, 1971. Diet atlas of India ICMR. New Delhi.
15. Grey and Hills S. 1972. the complete Hand book of nutrition. Report speller and sons pub., New York.
16. Browin H. 1974. Protein nutrition. Charls V. Thomas Publishers, Spring field Illinois U.S.A.

17. Lawrie R. A. 1970. Protein and human food AVI technical books Inc., West fort. Connecticut, USA.
18. Chemistry and biochemistry of food legumes 1982. Arora S.K: eds. Oxford and IBH Pub. House, New Delhi.
19. Plant protein. Norton G.Ed. 1978. Butterworths, London.
20. Leung H.K. and Saulinkhe D.K. 1985. Advances in food sciences. Academic press, New York.
21. Liener I.F. 1980. Toxic constitute in plant food stuffs Academic press, New York.
22. Toxicants occurring naturally in food. National academy of sciences, Washington, Cyberleas D.M. eds. 1973.
23. Jeans A. and Hodge J. 1975. Physiological effects of food carbohydrates, American Chemical Society, Washington D.C., USA.

BOTAE5

SEM.IV

## **HORTICULTURE**

### **UNIT I:**

History and importance of horticulture. Soil types and preparation and treatment. Chemical fertilizers – Nitrogen, phosphorous, potassium, mixed fertilizers, organic fertilizers and bio fertilizers. Methods of plant propagation – layering, cutting, grafting, budding and their advantages.

### **UNIT II:**

Lawn making, gardening, bonsai. Out door garden types and arrangements – annuals, biennials. Perennials with common examples and culture: influence of environment, training, pruning and transplanting.

### **UNIT III:**

Outdoor floriculture, cut flower, flower arrangement, Pomology – cultivation fruit crops – Mango, Grapes, spacing, irrigation, field disease control. Olericulture – cultivation of vegetables – Tomato, Ginger, Potato planting; Erosion control.

### **UNIT IV:**

Pest and weed management – historical, theoretical, philosophical and biological insect pest suppression. Weed problem and ecological perspective, biological control of weeds in Indian region.

### **UNIT V:**

A preliminary knowledge about glass houses – growth regulators in horticulture, growth retarders, sex modification, flower induction, parthenocarpy, harvesting seed storage, preservation of fruits and vegetables.

### **PRACTICALS:**

1. Fertilizers – biological and industrial.
2. Establishment of nursery, different containers, soil transplantation techniques.
3. Methods of raising a lawn.
4. Plant propagation – layering, cutting, grafting.

5. Visit to nursery and knowledge about the instruments used in horticulture.
6. Layout of garden, plan of a rock garden, glass house, kitchen garden, artificial pond.

#### **REFERNECES:**

1. Al David – A complete guide to gardens.
2. Manibushan Rao – Horticulture.
3. Nanda and Kochar – Vegetative propagation of plants.
4. Randhava G. S. – Floriculture in India.
5. Subba Rao – Bio fertilizers in India.
6. Vishnu Swarup – Garden flowers
7. Readers digest – Complete library of gardens (3 volumes) Kissan world.
8. Borthkur S. and Ghen – Studies on weeds and their control.
9. Reinert and Bajaj 1977 – Plant cell, tissue and organ culture, Narosa publication. New Delhi.

BOT AE5

SEM.IV

### **FOREST BOTANY**

#### **UNIT I:**

Scope; merits of combining traditional botany and forestry practices. General introduction to – forest, natural and man made; different examples: tropical, temperate, evergreen, semi evergreen, deciduous, monoculture, multipurpose, social, industrial. Forest and climate; forest and biodiversity, forest and gene conservation, forest and ecosystem, forest and civilization. Geographical history of the forest vegetation: natural Vs artificial. Characteristics of each. And categories under each. Special emphasizes on social forestry. Industrial forestry. Multipurpose forestry. And preservation of natural forestry, pollution control.

#### **UNIT II:**

Forest genetics, Forest physiology, forest ecology – strong interrelationships. Macro dynamic ecosystem reserves, hydrological cycles, balance. Identification of timber plants based on vegetative features. Seedlings, leaves, bark branching pattern architectural models of trees. Major and minor forest products, use and misuse of forests by man, direct and indirect forest wealth, forest policies, forest protection through peoples committee.

#### **UNIT III:**

Silviculture: concept and scope of study, forest in general form, composition, classification of world forests and Indian forests. Classification based on sites quality density, tolerance, crown; water cycles of forest. Photosynthetic processes in forest: nitrogen and mineral nutrition in forests.

#### **UNIT IV:**

Seed dynamics in forest: seed production, dissemination, germination, establishment and mortality, growth of trees in general terms – height, diameter, volume, growth of stands – gross increment, net increment, stand reaction to various types of cuttings.

Menturation: definition, direct measurements, direct and indirect estimate, and prediction. Measurement of diameter – rules and methods, measurement of height – different rules, methods, instruments, total height and merchantable length.

**UNIT V:**

Measurement of volume – common units, different methods and procedures of volume measurements. Measurement of age: direct estimate, averages, standard error, and sampling, General concept of indirect estimate based on one or more independent variables. Forestry for social and national development. Progress to be achieved in social forestry, industrial forestry and multiple forestry.

**PRACTICALS:**

1. Ecological studies on forest soil analysis, soil mycorrhiza, succession and natural balance in selected areas.
2. Biomass studies – based on number, energy, fresh and dry weight.
3. Selected forest ecosystem analysis through project work.
4. Defoliation studies related to climate.
5. Physiological studies on photosynthetic rates of different strata of vegetation.
6. Germination studies – percentage, competition.
7. Water demand, collection and evaporation in selected forest areas.
8. Physical features of wood – height, diameter, density, moisture, specific gravity, tension, strength, modulus of rupture.
9. Anatomical features of wood – porous, non-porous, ring-porous, diffused-porous, different kinds of wood parenchyma rays.
10. Menturation – measurement of tree height, diameter, volume, estimation, prediction, standard error, growth pattern and factors affecting growth.

**REFERENCES:**

1. Principles of silviculture, Frederick S. Backer, Mc Graw Hill Book Co. NY, 1950.
2. Forest menturation, Donald Bruce and Grancis X. Schumacher, Mc Graw Hill Book Co. NY, 1950.
3. Multipurpose tree germplasm, Ed. Burley S. and Von Carlowitz P. international council for research in agroforestry, Nairobi, 1984.
4. Tropical forests, Ed. Holm – Neilsen L.B. Nielsen. DC and balslev II Academic press, London, 1989.
5. Plant anatomy – A Fahn.
6. Plant anatomy – K. Esau.
7. Indian woods – six volumes Ed. Chowdhuri, Pub. Forest research institute, Dehra Dun.

## **DIPLOMA PAPER I. MEDICINAL PLANT BIODIVERSITY & CONSERVATION**

### **UNIT 1. Diversity:**

Diversity hot spots-Endemism-Rarity-endangered and Threatened Species. Distribution of medicinal plants in Indian scenario.

### **UNIT 2. Conservation of Medicinal Plants:**

Construction of Botanical gardens-Nature reserves-Biosphere-Wildlife sanctuaries-National parks-Sacred groves.

### **UNIT 3. Cultivation Practice:**

Medicinal plant multiplication and cultivation techniques-Agronomy of important commercial herbs.

### **UNIT 4. In vitro multiplication techniques-Media preparation for tissue culture-Direct regeneration (Nodal culture, Shoot tip culture) and Indirect regeneration (Inter node, leaf and root) - Cryopreservation techniques.**

### **UNIT 5. Centers of Medicinal Plant Conservation in India-IBPGRI-CIMAP-CDRI-NBGRI-MSSRF-KFRI-TAMPCOL-TBGRI-FRLHT.**

### **REFERENCES:**

1. Bhojwani, S. S. and Razdan, M. K. 1996. Plant Tissue Culture: Theory and Practice (a revised Edition), Elsevier Science Publishers, New York, USA.
2. Khan, T. I. and Shishoda, Y. S. 1998. Biodiversity Conservation and Sustainable development, Pointer Publishers, Jaipur, India.
3. Purohit, S. S. and Nyas, S. P. 2005. Medicinal Plant Cultivation: A Scientific Approach. Agrobios, Jodhpur, India.

## **DIPLOMA PAPER II. PHYTOCHEMISTRY AND INSTRUMENTATION**

### **UNIT 1. Primary metabolites:**

Carbohydrates, proteins and lipids and their classification-structure and functions.

### **UNIT 2. Secondary metabolites:**

Alkaloids, flavonoids, phenolic groups, terpenoids and glycosides-occurrence-distribution-biosynthesis-medicinal uses.

### **UNIT 3. Identification of secondary metabolites:**

Qualitative screening methods for alkaloids, flavonoids, phenolic groups and glycosides. Estimation of alkaloids, flavonoids, phenolic groups and glycosides from plant tissues.

### **UNIT 4. Extraction and separation techniques:**

Soxhlet extraction-Ultrasonic water bath extraction-Chromatography-Centrifugation-Electrophoresis.

### **UNIT 5. Phytochemical analysis and chemical characterization:**

Colorimeter-Spectrophotometer-HPLC-GC-MS-NMR.

### **REFERENCES:**

1. Dey, P. M. and Harborne, J. B. 2000. Plant Biochemistry, Harcourt Asia Pte Ltd, Singapore.
2. Harborne, J. B. 1975. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis, Chapman and Hall, London, UK.
3. Wilson, K. and Walker, J. 1995. Practical Biochemistry, University of Cambridge, New York, USA.
4. Panda, H. 2004. The Complete Technology Book on Natural Products (Forest based). Asia Pacific Business Press Inc. Delhi, India.

### **DIPLOMA PAPER III. PHARMACOGNOSY AND DRUG PRODUCTION**

UNIT 1. Crude drug identification:

Historical notes-Organoleptic identification-Microscopic identification-Pharmacognostic classification of herbal drugs.

UNIT 2. Microscopic drug identification:

Micromorphology of standard drugs-Histological maceration-Histochemical localization.

UNIT 3. Biochemical and Physicochemical evaluation of herbal drugs.

UNIT 4. Extraction of secondary metabolites from in vitro cultures-elicitation of drug production-drug evaluation and standardization.

UNIT 5. Extraction methods-from field grown plants and its purification.

#### **REFERENCES:**

1. Gokhale, S. B., Kokate, C. K. and Purohit, A. P. 2003. Pharmacognosy, Nirali Prakashan Publishers, Pune, India.
2. Singh, V. K., Govil, J. N. and Singh, G. 2002. Recent progress in Medicinal Plants: Vol 1 Ethnomedicine and Pharmacognosy. SCI Tech Publishing, LLV, USA.
3. NIIR Board of Consultants & Engineers, 2004. Drugs & Pharmaceutical: Technology and Hand book, Asia Pacific Business Press Inc. Delhi, India.

### **DIPLOMA PAPER IV. PHARMACOLOGY**

UNIT 1. Introduction to pharmacology-dermatitis and wound healing herbs-techniques involved in aseptic and wound healing properties of drugs.

UNIT 2. CNS-psycho-active herbs and mechanism of action. Respiration related herbs and its mechanism of action.

UNIT 3. Stomach and digestion related herbs and mechanism of action-antidiabetic related herbs and its mechanism of action.

UNIT-4. Antioxidant and its mechanisms-Hepatoprotective drugs-markers of Hepatoprotectivity.

UNIT 5. Introduction to toxicology-acute and chronic toxicity-Drug interaction.

#### **REFERENCES:**

1. Singh, S. Govil, J. N. and Singh, V. K. 2003. Recent Progress in medicinal plants: Volume 2 – Phytochemistry and Pharmacology, Studium Press LLC, USA.
2. Singh, S. Govil, J. N. and Singh, V. K. 2003. Recent Progress in medicinal plants: Volume 8 – Phytochemistry and Pharmacology, Studium Press LLC, USA.
3. Duke, J. A. 1997. The Green Pharmacy, Scientific Publishers, Jodhpur, India.

**MODAL QUESTION PAPERS**  
**M.SC. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**  
**1<sup>st</sup> SEMESTER**

**Core paper**

**Code: BOT AC1**

**Paper I : Phycology, Mycology, Bacteriology and Lichenology**

**Time: 3 hours**

**Max. Marks 75**

**SECTION – A ( 10 x 1 = 10 Marks)**

Answer All questions. All Questions carry equal marks

1. Incipient nucleus
2. Floridean Starch
3. Crozier formation
4. Penicillin
5. Mucopolypeptides
6. Pure culture
7. T<sub>2</sub> Bacteriophage
8. Concatamers
9. Heteromorous Lichens
10. Soredia

**SECTION – B ( 5 x 5 = 25 Marks)**

Answer All questions. All Questions carry equal marks

- 11a. Describe the structure of Chlorophycean alga.  
(OR)
- b. Explain the asexual reproduction in algae.
- 12a. Describe the general characteristic features of Oomycetes  
(OR)
- b. How fungi reproduce sexually?
- 13a. Outline the classification of Bacteria by Bergey.  
(OR)
- b. Describe the ultra structure of bacteria with illustration
- 14a. Write critical notes on AIDS  
(OR)
- b. Describe the structure of double stranded DNA virus that you studied
- 15a. Lichens as indicators of pollution. Justify the statement.  
(OR)
- b. Describe the asexual reproduction in Lichens.

**SECTION – C ( 5 x 8 = 40 Marks)**

Answer All questions. All Questions carry equal marks

- 16a. Describe the phylogeny and interrelationship of Rhodophyta with that of Phaeophyta.  
(OR)
- b. Write an essay on economic importance of algae

- 17a. Compare and contrast Basidiomycetes with that of Ascomycetes  
(OR)
- b. Write an essay on Host-parasite interaction
- 18a. Write the flow chart and preparation of vinegar  
(OR)
- b. Describe the isolation and maintenance technique of pure culture of bacteria.
- 19a. Describe the structure and replication of bacteriophage  
(OR)
- b. Explain the symptoms, causal organism and control measures of wound tumour disease.
- 20a. Describe the morphology and internal structure of fruticose lichen.  
(OR)
- b. Give an account of economic importance of lichen.

### 1<sup>st</sup> SEMESTER

**Core paper**

**Code: BOT AC2**

**PAPER II : BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS**

**Time: 3 hours**

**Max. Marks : 75**

#### SECTION – A (10 x 1 = 10 marks)

Answer **ALL** questions. All questions carry equal marks.

1. Elators
2. Gemma
3. Apogamy
4. Impressions and Compressions
5. Fossil Cycads
6. *Calamites*
7. Eusporangiate
8. Birbal Sahni
9. Prothallus
10. Female gametophyte of *Gnetum*

#### SECTION – B ( 5 x 5 = 25 marks)

Answer **ALL** questions. All questions carry equal marks.

- 11a. Economic importance of Bryophytes  
OR
- b. Fossil Bryophytes
- 12a. Describe reproduction in Lycopsida  
OR

- Give anatomical features of Sphenopsida
- b.**
- 13a.** Write notes on sorus evolution **OR**  
Describe methods of fossilization
- b.**
- 14a.** Give the classification of Gymnosperms **OR**  
**b.** Give a general account of Bennettitales
- 15a.** Describe the features of Cordaitales **OR**  
**b.** Give a general account of Gnetales
- SECTION – C ( 5 x 8 = 40 marks)**

Answer **ALL** questions. All questions carry equal marks.

- 16a.** Describe the development and structure of Sporophyte in *Anthoceros* **OR**  
**b.** Describe the life cycle of *Polytrichum*
- 17a.** Describe morphological, anatomical and reproductive structures of *Psilophytum* **OR**  
**b.** Give the classification of Pteridophytes
- 18a.** Discuss the evolution of stele in Pteridophytes **OR**  
**b.** Write an essay on Heterospory and seed habit in Pteridophytes with suitable examples.
- 19a.** Give a general account of Pentoxylales **OR**  
“Ginkgo is a living fossil”. Discuss
- b.**
- 20a.** Give general characters of Taxales **OR**  
**b.** Discuss phylogenetic trends and affinities of various classes of Gymnosperms. Add a note on angiosperm characters in certain Gymnosperms.

### 1<sup>st</sup> SEMESTER

### Paper III: GENETICS, PLANT BREEDING & BIOSTATISTICS

**Core Paper**

**Code: BOT AC 3**

**Time: 3 hours**

**Max. Marks 75**

#### SECTION A – (10 x 1 = 10 marks)

Answer **ALL** questions. All questions carry equal marks.

1. What is allele?
2. Write on Mendel
3. What is Independent assortment
4. Mutations leading to what?
5. Hybridization means what?

6. What is diploid condition
7. Cryopreservation refers to what?
8. What is Electro phoration?
9. How do you collect primary data?
10. Write on standard deviation?

**SECTION B – (5 x 5 = 25 marks)**

Answer **ALL** questions. All questions carry equal marks.

11. (a) Distinguish between sex linked and sex limited characters.  
(OR)  
(b) Write an account of interaction of genes with special reference to epistasis.
12. (a) Explain the fine structure of gene.  
(OR)  
(b) Describe genetic drift.
13. (a) Plant breeding work in India with special reference to cotton.  
(OR)  
(b) Role of polyploidy in crop improvement.
14. (a) What are red data books?  
(OR)  
(b) Explain the rights of plant breeders.
15. (a) Explain graph and tabulation.  
(OR)  
(b) Distinguish standard error and standard deviation.

**SECTION C – (5 x 8 = 40 marks)**

Answer **ALL** questions. All questions carry equal marks.

16. (a) Write an account of sex determination in plants.  
(OR)  
(b) Explain the molecular basis of mutation with a note on chemical mutagens and their actions.
17. (a) Write an essay on extrachromosomal inheritance.  
(OR)  
(b) Explain the gene expression in Eukaryotes and Prokaryotes.
18. (a) Describe self-fertilized and cross fertilized plant with special reference to crop improvement.  
(OR)  
(b) Explain breeding plants for improving yield at resistant to diseases.
19. (a) Describe the medicinal plants germplasm collection and conservation.  
(OR)  
(b) Explain the role of IBPGR in patent and intellectual maintenance.
20. (a) Write an account of the characteristic features of binomial and normal Distribution  
(OR)  
(b) Explain the analysis of variance with suitable example.

**1<sup>st</sup> SEMESTER****Core paper****Code: BOTAC 4****Paper IV: CELL & MOLECULAR BIOLOGY****Time: 3 hours****Max. Marks 75****SECTION A – (10 x 1 = 10 marks)**Answer **ALL** questions. All questions carry equal marks.

1. Write on chloro plast?
2. Write on tRNA
3. Write on Lysosome
4. Write on mitochondria?
5. Write on xyloglucons
6. Write on plasmodium?
7. Write on homology?
8. Nucleogenesis refers to what?
9. Write on Z nucleotides
10. What are amino acids?

**SECTION B – (5 x 5 = 25 marks)**Answer **ALL** questions. All questions carry equal marks.

11. (a) Point out the Physicochemical properties of Cytoplasm.  
(OR)  
(b) Explain the differences in the structural components of 70s and 80s ribosomes
12. (a) Write on the nature of bordered pits.  
(OR)  
(b) Point out how chitin and suberin are distributed in plants.
13. (a) Explain the biochemistry of spindle fibre.  
(OR)  
(b) Briefly describe CELL CYCLE.
14. (a) Comment on DNA repair mechanisms.  
(OR)  
(b) Point out the structure of chloroplast DNA.
15. (a) Give the features of Holley's model of transfer RNA.  
(OR)  
(b) Explain X-ray diffraction microscopy and its utility.

**SECTION C – (5 x 8 = 40 marks)**Answer **ALL** questions. All questions carry equal marks.

16. (a) Write critically on origin, types and role of plastids.  
(OR)  
(b) Point out the origin, structure and functions of Golgi apparatus.
17. (a) Describe in detail the biochemistry and organization of lignin in the secondary wall.  
(OR)  
(b) Describe the ultra structure of Nucleus.

18. (a) Critically evaluate the structure of Chromosome.  
(OR)  
(b) With Illustrations explain the process of Meiosis.
19. (a) Give in detail the experimental proof for semi conservative replication of DNA.  
(OR)  
(b) Illustrate the biochemical structures of regular and unusual base found in DNA.
20. (a) Trace in detail the events associated with transcription of DNA.  
(OR)  
(b) Comment on the experiments that led to cracking of Genetic code.

## 2<sup>nd</sup> SEMESTER

**Core paper**

**Code: BOT AC5**

**Paper V: Anatomy, Embryology and Tissue Culture**

**Time: 3 hours**

**Max. Marks 75**

### SECTION – A ( 10 x 1 = 10 Marks)

Answer All questions. All Questions carry equal marks

1. Intercalary meristem
2. Wound healing
3. Dendrochronology
4. Unilacunar node
5. Sporopollenin
6. Endothelium
7. GA<sub>3</sub>
8. Deplospory
9. Cryopreservation
10. Fusogen

### SECTION – B ( 5 x 5 = 25 Marks)

Answer All questions. All Questions carry equal marks

- 11a. Describe the structure of vascular cambium  
(OR)  
b. Trace the ontogeny of a typical monocot leaf
- 12a. Describe the arrangement of vessels in secondary xylem of dicots  
(OR)  
b. Describe the development of heart wood
- 13a. Discuss the ultra structure of pollen wall  
(OR)  
b. Give an account of the nutrition of the embryosac
- 14a. Describe the various types of haustoria associated with cellular endosperm  
(OR)  
b. Trace the development of a typical monocot embryo

- 15a. Describe the various steps involved in the isolation of protoplast  
(OR)  
b. Describe the role of growth promoting substances in tissue culture

**SECTION – C ( 5 x 8 = 40 Marks)**

Answer All questions. All Questions carry equal marks

- 16a. Describe any two types of anomalous secondary thickening studied by you  
(OR)  
b. Give an account of apical meristem
- 17a. Discuss the phylogenetic trends of specialization of primary xylem  
(OR)  
b. Describe the various types of nodes and add a note on its evolutionary significance
- 18a. Describe the various methods to overcome incompatibility  
(OR)  
b. Describe the development of monosporic embryo sac
- 19a. Write an essay on parthenocarpy  
(OR)  
b. Discuss embryology in relation to taxonomy
- 20a. Discuss the role of tissue culture in plant improvement programmes  
(OR)  
b. How will you obtain virus free clones through tissue culture? Add a note on its applications.

**2<sup>nd</sup> SEMESTER**

**Core paper**

**Code: BOT AC6**

**PAPER VI : ENVIRONMENTAL BOTANY & CONSERVATION BIOLOGY**

**Time: 3 hours**

**Max. Marks : 75**

**SECTION – A (10 x 1 = 10 marks)**

Answer **ALL** questions. All questions carry equal marks.

1. Trophic structure
2. Climax community
3. Biomagnification
4. Species diversity
5. Food web
6. EIA
7. Global warming
8. MAB
9. IUCN
10. UNEP

**SECTION – B ( 5 x 5 = 25 marks)**

Answer **ALL** questions. All questions carry equal marks.

- 11a.** Write short notes on synecology  
(OR)  
**b.** Discuss modern concept of biotic community
- 12a.** Write notes on Ecological indicators  
(OR)  
**b.** Give an account of Bioremediation
- 13a.** Write notes on Noise pollution  
(OR)  
**b.** Give sources, effects and control measures of Radiation pollution
- 14a.** .Discuss about environmental education programmes  
(OR)  
**b.** Give an account of environmental education in India
- 15a.** Discuss forest conservation through Laws  
(OR)  
**b.** Write notes on agroforestry and social forestry

**SECTION – C ( 5 x 8 = 40 marks)**

Answer **ALL** questions. All questions carry equal marks.

- 16a.** Define ecosystem. Discuss homeostasis of ecosystem and energy dynamics in ecosystem  
(OR)  
**b.** Describe methods of studying plant community
- 17a.** Write in detail about global carbon cycle. Why carbon dioxide levels of the atmosphere oscillate in its annual cycle?  
(OR)  
**b.** Discuss cycling pattern in Tropical regions
- 18a.** Discuss the sources, effects and control measures of Air Pollution  
(OR)  
**b.** Give an account of sources, effects and control measures of water pollution
- 19a.** Discuss about environmental organization and agencies  
(OR)  
**b.** Give a detailed account on Indian forests and wild life.
- 20a.** Discuss *ex situ* and *in situ* preservation of natural resources  
(OR)  
**b.** Give the details of World conservation strategy

**3<sup>rd</sup> SEMESTER****Core paper****Code: BOT AC7****Paper VIII: TAXONOMY & BIOSYSTEMATICS****Time: 3 hours****Max. Marks: 75****SECTION - A (10 x 1= 10 marks)**Answer **ALL** questions. All questions carry equal marks

1. Species Plantarum
2. Binomial Nomenclature
3. Flower of Polygala
4. Pink Family
5. Martynia
6. Economic importance- Aroideae
7. Kew Botanical garden
8. Serotaxonomy
9. Dendrogram
10. OTU

**SECTION - B (5 x 5 = 25 marks)**Answer **ALL** questions. All questions carry equal marks

- 11 a. Discuss the merits and demerits of Engler and Prantl system of classification  
(OR)  
b. Briefly point out the concept of Typification
- 12 a. Evaluate the characters of Menispermaceae in the light of its phylogeny  
(OR)  
b. Comment on embryological characters of Trapa
- 13 a. Describe the flower of Commelinaceae  
(OR)  
b. Underline the inflorescence and flower in Cyperaceae
- 14 a. Give a brief account on the contribution of J. D. Hooker to Indian Floristic study  
(OR)  
b. Write an account of keys.
- 15 a. 'Phenotypic Plasticity' – Discuss  
(OR)  
b. Briefly explain genecology

**SECTION - C (5 x 8= 40 marks)**Answer **ALL** the questions. All questions carry equal marks.

- 16 a. Describe the salient features of International Code of Botanical Nomenclature.  
(OR)  
b. Give an account of Hutchinson system of classification of angiosperm.
- 17 a. Explain the features of taxonomic interest in Aizoaceae and examine its systematic position  
(OR)  
b. Describe the vegetative and floral characters of Lythraceae.
- 18 a. Explain the floral features of Oleaceae with its economic importance.  
(OR)  
b. Differentiate Nyctaginaceae and Chenopodiaceae. Point out their systematic position.
- 19 a. Explain the role of phytochemistry in solving taxonomic problems.  
(OR)  
b. How far embryology and palynology are useful in solving taxonomic problems.
- 20 a. Critically examine the classical experiments of Turresson.  
(OR)  
b. Write an essay on Numerical Taxonomy.

**3<sup>rd</sup> SEMESTER****Core paper****Code: BOT AC8****Paper IX : BIOTECHNOLOGY & GENETIC ENGINEERING****Time: 3hours****Max. Marks: 75****SECTION –A (10 x 1=20 Marks)****Answer all questions. All questions carry equal marks**

1. Palindrome
2. Cosmid
3. Reporter genes
4. Sat-RNA
5. Sequence garing
6. Pertubation theory
7. Defibratation
8. Xenobiotics
9. Pseudo extinction
10. Copy rights

**SECTION –B (5 x 5 = 25 Marks)****Answer all questions. All questions carry equal marks.**

- 11a. Briefly describe the different types of cloning vectors.  
(OR)
- b. Explain the methods of synthesis of genes.
- 12a. Discuss the targeting of foreign proteins in to chloroplasts.  
(OR)
- b. Explain the transgenic plants for molecular farming.
- 13a. Write critical notes on Nod gene.  
(OR)
- b. Write short notes on protein modelling
- 14a. Define biofertilizer and describe the mass cultivation of Azolla.  
(OR)
- b. Explain the process of biomineralization.
- 15a. Describe the different types of biodiversity .  
(OR)
- b. Write short notes on genebanks

**SECTION –C (5 x 8= 40 Marks)****Answer all questions. All questions carry equal marks.**

- 16a. Describe the process of Polymerase Chain Reaction.  
(OR)
- b. Explain the isolation techniques of genes.
- 17a. Describe the methods of DNA mediated gene transfer  
(OR)
- b. Explain the preparation of RFLP genetic maps in plants.
- 18a. Explain the various methods for protein engineering  
(OR)
- b. How encapsulated seeds are produced?
- 19a. Discuss the role of biotechnology in paper industry.  
(OR)

- b. Give an account of ethanol production by microbial fermentation.  
 20a. Write an essay on ex-situ conservation  
**(OR)**  
 b. Write an essay on patenting of biological materials.

### 3<sup>rd</sup> SEMESTER

Core paper

Code: BOT AC9

**Paper X: PLANT PHYSIOLOGY & BIOCHEMISTRY**

Time: 3 hours

Max. Marks: 75

#### SECTION - A (10 x 1 = 10 marks)

Answer **ALL** questions. All questions carry equal marks

1. Diffusion.
2. Matric potential.
3. Emerson enhancement effect.
4. Kranz type of anatomy.
5. Anaerobic respiration.
6. Acetyl Co A.
7. Holoenzyme.
8. Asymmetric Carbon atom.
9. Isoelectric point.
10. Lecithin.

#### SECTION B (5 x 5 = 25 marks)

Answer **ALL** questions. All questions carry equal marks.

11 a. Describe the biological significance of water.

**(OR)**

b. Explain water potential.

12 a. Explain the organization of thylakoids in the chloroplast with diagram.

**(OR)**

b. Describe the outline of CAM pathway.

13 a. Write short notes on respiratory quotient.

**(OR)**

b. Explain the energy conversion stages of glycolysis.

14 a. Describe the factors influence the rate of enzyme-catalyzed reactions.

**(OR)**

b. Explain the laws of thermodynamics.

15 a. Explain Zwitter ion isomerism.

**(OR)**

b. Write about plant waxes and steroids.

#### SECTION C (5 x 10 = 50 marks)

Answer **ALL** the questions. All questions carry equal marks.

16 a. Explain the possible mechanism of solutes and assimilates.

**(OR)**

b. Explain the regulatory mechanism of stomatal behaviour.

17 a. Give an account of Calvin cycle.

(OR)

b. Give an account of cyclic and non-cyclic photophosphorylation.

18 a. Explain the Krebs's cycle.

(OR)

b. Explain the factors influence respiration.

19 a. Give an account of classification, structure and properties of functional groups of carbohydrates.

(OR)

b. Describe the properties and mechanisms of enzyme action.

20 a. Give an account of classification and properties of lipids.

(OR)

b. Give an account of classification and properties of amino acids.

## 2<sup>nd</sup> SEMESTER

**Elective Paper:**

**Code: BOTAE 1**

**PALER VII: ELECTIVE 1: INTRODUCTION TO BIOINFORMATICS.**

**Time : 3 Hrs.**

**Max. Marks 75**

**Section A (10 X 1 = 10 marks)**

**Answer ALL questions. All questions carry equal marks.**

1. Margaret Day-Hoff
2. RAM
3. Task bar
4. Bandwidth
5. FASTA format
6. Gi number
7. InDels
8. Conserved residue
9. GenScan
10. ProDom

**Section B (5 X 5 = 25 Marks)**

**Answer ALL questions. All questions carry equal marks.**

11 a. Trace the history of bioinformatics.

(OR)

b. Describe memory units of a computer.

12 a. What is an operating system? Give examples.

(OR)

b. Distinguish HTTP from FTP.

13 a. Describe the structure of a database.

(OR)

b. Distinguish primary from secondary database.

14 a. Which is better- local or global alignment?

(OR)

b. Define gap penalties.

15 a. Why does an ORF finder give 6 ORFs for a given sequence?

(OR)

b. What is a protein motif.

**Section C (5 X 8 = 40 marks)**

**Answer ALL questions. All questions carry equal marks.**

16 a. Describe various auxiliary storage devices.

(OR)

b. Give an account of various printers.

17 a. Internet has shrunk the world – discuss.

(OR)

b. Explain the steps in power point presentation.

18 a. Narrate how a biologist can make use of literature database.

(OR)

b. Give an account of nucleotide sequence databases.

19 a. What are homologous sequences? Describe the various types.

(OR)

b. How will you perform a multiple sequence alignment? What do you derive from such an alignment.

20 a. Explain why gene finding is more difficult in eukaryotes than in prokaryotes.

(OR)

b. Bring out the significance of protein structure prediction.

**3<sup>rd</sup> SEMESTER**

**Elective paper**

**Code BOT AE 2**

**Paper XI: Elective II – PHYTOPATHOLOGY**

**Time : 3 Hrs.**

**Max. Marks 75**

**SECTION A – (10 x 1 = 10 marks)**

**Answer ALL questions. All questions carry equal marks.**

1. What is damping off disease?
2. Define obligate Parasite
3. Define club root disease
4. Write about Bordeaux mixture
5. What is chlorosis
6. Pandemic disease refers to what?
7. Write about foliar spray
8. What is quartanite?
9. What is Biocontrol?
10. Blackarm disease of cotton is due to what?

**SECTION B – (5 x 5 = 25 marks)**

**Answer ALL questions. All questions carry equal marks.**

11. (a) What is meant by quarantine?

**(OR)**

(b) Write briefly on plant disease forecasting?

12. (a) Describe the pathogen, symptoms and control measures of angular leaf spot disease of cotton.

**(OR)**

(b) Name the pathogen, symptoms and control measures of early blight of potato.

13. (a) Discuss the role of toxins in relation to plant disease.

**(OR)**

(b) Give an account of the role of fungal enzymes in plant disease.

14. (a). Write short note on the role of growth regulations in plant responses to post infectious agents.

**(OR)**

(b). Briefly explain the plant responses to post infectious effect on Nitrogen metabolism.

15. (a). Discuss epidemiology of plant disease

**(OR)**

(b). Briefly explain host-parasite defense mechanisms.

**SECTION C – (5 x 8 = 40 Marks)**

**Answer ALL questions. All questions carry equal marks.**

16. (a). Explain biological control of plant diseases.

**(OR)**

(b). Give an account of classification of plant diseases.

17. (a) Explain the disease cycle of club root of crucifers.

**(OR)**

(b) Describe the disease cycle of powdery mildews of wheat.

18. (a) What is meant by pathogenesis? Write an account of penetration and entry of plant pathogens.

**(OR)**

(b). Write an account of various factors affecting infection of pathogen.

19. (a) Explain the role of aromatic compounds in plant responses to post infectious agents.

**(OR)**

(b) Describe the plant responses to post infectious effects on photosynthesis and respiration.

20. (a). Explain the effect of environment on disease development

**(OR)**

(b). Give an account of the genetics of plant pathogen interaction.

**4<sup>TH</sup> SEMESTER****Elective paper****Code BOT AE 3****Paper XII: Elective iii – PHYSIOLOGICAL EMBRYOLOGY OF ANGIOSPERMS****Time : 3 Hrs.****Max. Marks 75****SECTION A – (10 x 1 = 10 marks)****Answer ALL questions. All questions carry equal marks.**

1. What are endothelial cells?
2. Write about Tapetum?
3. Write about micropyle
4. What is Apogamy?
5. What is megaspore?
6. Suspensor refers to what?
7. What are antipodal cells?
8. Endosperm
9. Write Embryo of sunflower?
10. Filiform apparatus refers to what?

**SECTION B – (5 x 5 = 25 marks)****Answer ALL questions. All questions carry equal marks.**

11. (a) Explain pollen germinability and pollen sterility.  
(OR)  
(b) Write the cytology and physiology of tapetum.
12. (a) Write about egg apparatus.  
(OR)  
(b) Describe Ultra structure of components of female gametophyte.
13. (a) Explain physiology and morphological relationship of endosperm and embryo.  
(OR)  
(b) Write about cytology and function suspensor in embryo.
14. (a) Write about development of Endosperm in plants.  
(OR)  
(b) Explain the storage metabolites in endosperm
15. (a) Write about the role of growth substances in fruit development  
(OR)  
(b) Explain the scope of embryology present and future status.

**SECTION C – (5 x 8 = 40 marks)****Answer ALL questions. All questions carry equal marks.**

16. (a) Write an essay on morphology, cytology and anatomy of anther and pollen.  
(OR)  
(b) Describe anther and pollen culture and their importance in plant breeding
17. (a) Explain Synergid and antipodal haustoria type and functions.  
(OR)  
(b) Write an essay on double fertilization and triple fusion in plants.

18. (a) Describe elaborately different types embryo development in plants.  
(OR)  
(b) Write an essay on Apomixis and polyembryony and its importance in plants breeding.
19. (a) Explain different types of endosperm haustoria, their extension persistence and function.  
(OR)  
(b) Write an essay on Endosperm culture and its importance.
20. (a). Describe Embryology in relation to physiology.  
(OR)  
(b) Write an essay on parthenocarpy.

#### 4<sup>TH</sup> SEMESTER

Elective paper

Code BOT AE 4

Paper XIII: Elective - IV: INDUSTRIAL MICROBIOLOGY

Time: 3 Hrs

Max.Marks: 75

#### SECTION B – (10 x 1 = 10 marks)

Answer ALL questions. All questions carry equal marks.

1. Extracellular enzyme
2. Louis Pasteur
3. *Spirullina maxima*
4. Hetero fermentors
5. Stock culture
6. Oxidation pond
7. LD<sub>50</sub> value
8. Vinegar
9. *Pullularia* sp.
10. Calcium alginate

#### Section B (5 X 5=25 marks)

Answer ALL questions. All questions carry equal marks.

- 11 a. Trace the history of Industrial microbiology  
(OR)  
b. Mention the industrial applications of any three enzymes.
- 12 a. List the role of microbes in cottage industries.  
(OR)  
b. Give an account of rhizosphere.
- 13 a. Describe how you will specifically isolate cellulase producing microbes.  
(OR)  
b. Explain the technique of enrichment culture.
- 14 a. List any six antibiotics, their source organism and their biological spectrum.  
(OR)  
b. Mention the uses of citric acid, lactic acid and vinegar.

15 a. How is discoloration of painted surfaces brought about?

(OR)

b. Explain how bioremediation of oil spills can be done.

**Section C (5 X 8 = 40 marks)**

**Answer ALL questions. All questions carry equal marks.**

16 a. Describe the industrial production of riboflavin using microbes.

(OR)

b. Give an account of steps in the production of any industrial enzyme.

17 a. Enumerate the role of microbes in solving protein malnutrition problem.

(OR)

b. Discuss the role of microbes in soil.

18 a. Describe the process of strain selection for any fermentation product in the industry.

(OR)

b. Narrate how biological waste treatment is carried out.

19 a. Explain the industrial production of any one aminoacid.

(OR)

b. Define microbial transformation. Explain the production of any compound by such process.

20 a. Bring out the role of microbes in petroleum industry.

(OR)

b. Define immobilized cell technology. How is it carried out? List its advantages/

**4<sup>TH</sup> SEMESTER**

**Elective paper**

**Code BOT AE 5**

**PAPER XIV : ELECTIVE V - HORTICULTURE**

**Time: 3hours**

**Max. Marks: 75**

**SECTION –A (10 x 1=10 Marks)**

**Answer all questions. All questions carry equal marks**

1. Muck
2. Air layering
3. Training
4. Transplanting
5. Olericulture
6. Ley farming
7. Myco pesticide
8. Alligator weed
9. Parthenocarpy
10. Growth retarder

**SECTION –B (5 x 5= 25 Marks)****Answer all questions. All questions carry equal marks.**

11a. Describe the methods of grafting

**(OR)**

b. Explain the role of organic fertilizer in crop improvement

12a. Give an account of process of Lawn making.

**(OR)**

b. Write short notes on Kitchen garden.

13a. Explain the cultivation method of Mango

**(OR)**

b. Write critical notes on Ikabana

14a. List out the problems caused by weeds in agricultural field.

**(OR)**

b. Discuss the ecological perspectives of weeds

c.

15a. How sexes and modified?

**(OR)**

b. How the seeds are stored for longer period?

**SECTION –C (5 x 8= 40 Marks)****Answer all questions. All questions carry equal marks.**

16a. Write an essay on chemical fertilizers

**(OR)**

b. Give an account of different types of soil

17a. Explain the techniques of bonsai

**(OR)**

b. Describe the methods of pruning plants.

18a. write an essay on outdoor floriculture

**(OR)**

b. Describe the biological methods of control of water erosion.

19a. How weeds are controlled by biological methods?

**(OR)**

b. Explain the processes of biological insect suppression.

20a. Describe the preservation techniques of fruits and vegetables.

**(OR)**

b. Discuss the role of growth regulators in horticulture.

**4<sup>TH</sup> SEMESTER****Elective paper****Code BOT AE 5****Paper XIV: Elective Paper V - FOOD SCIENCE & NUTRITION****Time: 3hours****Max. Marks: 75****SECTION –A (10 x 1=10 Marks)****Answer all questions. All questions carry equal marks**

1. Protective food
2. FAO
3. Fermentation
4. Decoration
5. Vitamins

6. Dietary fibre
7. Arthrosclerosis
8. Lipids
9. Cyanogens
10. Allergens.

**SECTION –B (5 x 5= 25 Marks)**

**Answer all questions. All questions carry equal marks.**

- 11a. Write the RDA for an adult heavy working man.  
**(OR)**
- b. List out the factors to be considered while planning Menu.
- 12a. What are the main differences between pulses and nuts?  
**(OR)**
- b. Write the composition of soybean
- 13a. Write the nutritional importance of protein.  
**(OR)**
- b. Describe the nutritional importance of Minerals.
- 14a. Explain the importance of essential aminoacids  
**(OR)**
- b. Describe the effects of deficiency and excess of Fats.
- 15a. Write critical notes on haemagglutinins.  
**(OR)**
- b. Write short notes on Lathyrogens.

**SECTION –C (5 x 8= 40 Marks)**

**Answer all questions. All questions carry equal marks.**

- 16a. Write the 3 types of food groups and explain any one classification with sources and nutrients.  
**(OR)**
- b. Compare the Indian recommended allowances with that of WHO standards.
- 17a. Describe the methods of cooking.  
**(OR)**
- b. Explain the advantages of germination of pulses.
- 18a. Discuss the role of dietary fibre in digestion and utilization.  
**(OR)**
- b. Describe the strategies for combating malnutrition.
- 19a. Discuss the role of essential fatty acids in the body.  
**(OR)**
- b. Describe the indices of protein quality evaluation
- 20a. Explain the naturally occurring food toxicants.  
**(OR)**
- b. Write an essay on naturally occurring carcinogen.

**4<sup>TH</sup> SEMESTER**

**Elective paper**

**Code BOT AE 5**

**PAPER XIV: ELECTIVE PAPER V- COURSE TITLE : FOREST BOTANY**

**Time: 3 hours**

**Max. Marks : 75**

**SECTION –A (10 x 1=10 Marks)**

**Answer all questions. All questions carry equal marks**

1. Shola
2. Chipko andolan
3. Pollution control
4. Quadrat analysis
5. Indian Forest Act
6. Monoculture
7. Biomass
8. Menturation
9. Standard Error
10. Mycorrhiza

**SECTION – B ( 5 x 5 = 25 Marks)**

**Answer ALL questions. All questions carry equal marks.**

- 11a. Write notes on Industrial forestry and multipurpose forests  
(OR)
  - b. Give the geological history of forest vegetation
- 12a. Write notes on forest genetics  
(OR)
  - b. How do you identify timber plants through vegetative characters?
- 13a. Give an account of Nitrogen and Mineral nutrition in forests  
(OR)
  - b. Give water cycles in forests
- 14a. .Discuss about seed production and seed germination of forest trees.  
(OR)
  - b. Give an account of stand reaction to various types of cutting
- 15a. Discuss how forestry is useful for social and National development  
(OR)
  - b. Discuss about progress to be achieved in social forestry

**SECTION – C ( 5 x 8 = 40 Marks)**

**Answer ALL questions. All questions carry equal marks.**

- 16a. Write an essay on types of forests in India  
(OR)
  - b. Give a detailed account on forests and Biodiversity and forests and gene conservation

- 17a. Give a detailed account on major and minor forest products  
(OR)  
b. Discuss about forest ecology
- 18a. Give classification of forests based on its quality, density, tolerance and crown  
(OR)  
b. Write an essay on Silviculture
- 19a. Describe the details of growth parameters of forests  
(OR)  
b. Discuss rules, methods and instruments for measurement of diameter and height of trees.
- 20a. Give the details of measurement of volume in forest trees  
(OR)  
b. Discuss about measurement of age through direct estimate and indirect estimate