S.D.N.B. VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)

(REACCREDITED WITH "A" GRADE BY NAAC)

CHENNAI 600 044

SYLLABUS AND REGULATIONS

CBCS

P.G DEPARTMENT OF PLANT BIOLOGY &
PLANT BIOTECHNOLOGY

For 2016 Batch onwards

FOR THE ACADEMIC YEAR 2016 - 2017

M.SC. PLANT BIOLOGY & PLANT BIOTECHNOLOGY

CHOICE BASED CREDIT SYSTEM

COURSE OF STUDY AND SCHEME OF EXAMINATIONS

S.No	Year/ Semester	Part	Subject	Subject code	Title of the Paper	Credits	CIA	ESE	Total
1.	I year I Semester	I	Core Major I	PPB/CT/1001	Algae, Fungi, Microbiology	4	25	75	100
2.		I	Core Major II	PPB/CT/1002	Bryophytes, Pteridophytes, Gymnosperms& Paleobotany	4	25	75	100
3.		I	Core Elective I		Plant pathology	3	25	75	100
4.		I	Core Elective II		Applications of Algae	3	25	75	100
5.		I	Core Major Practical-I	PPB/CP/1001	Covering Paper I & II	4	40	60	100
6.		II	Soft Skills	SSA	Essentials of Spoken and Presentation Skills	2	20	80	100
TOTAL MARKS						**MAJOR – 300; ELECTIVE - 200**			
7.	I Year II Semester	I	Core Major III		Taxonomy of Angiosperms and Economic Botany	4	25	75	100
8.		I	Core Major IV		Cell Biology	4	25	75	100
9.		I	Core Major V		Plant Anatomy, Embryology, Palynology	4	25	75	100
10.		I	Core Elective III		Molecular biology and Genetic Engineering	3	25	75	100
11.		I	Core Major Practical- II	PPB/CP/2002	Covering Paper III, IV &V	4	40	60	100
12.		I	Extra Disciplinary - I	PPB/NE/2BI 1	Basics of Bioinformatics (for M. Sc Biostatistics)	3	40	60	100
13.		II	Soft Skills	SSB	Essentials of Spoken and Presentation Skills Advanced Level	2	20	80	100
TOTAL MARKS						**MAJOR – 400; ELECTIVE – 100; Extra Disciplinary - 100**			

S.No	Year/ Semester	Part	Subject	Subject code	Title of the Paper	Credits	CIA	ESE	Total
14.	II year III Semester	I	Core Major VI		Genetics, Plant Breeding and Evolution	4	25	75	100
15.		I	Core Major VII		Plant Tissue Culture	4	25	75	100
16.		I	Core Major VIII		Ecology and Phytogeography	3	25	75	100
17.		I	Core Elective IV		Bioinstrumentation and Bioinformatics	3	25	75	100
18.		I	Core Major Practical-III	PPB/CP/3003	Covering Paper VI, VII & VIII	4	40	60	100
19.		I	Extra Disciplinary - II	PPB/NE/2BI 1	Basics of Bioinformatics (for M. Sc Physics)	3	40	60	100
20.		II	Internship	ISP	Internship	2	-	-	-
21.		II	Soft Skills	SSC	Personality Enrichment	2	20	80	100
TOTAL MARKS					**MAJOR – 400; ELECTIVE – 100; Extra Disciplinary - 100**				
22.	II Year IV Semester	I	Core Major IX		Plant Physiology and Biochemistry	4	25	75	100
23.		I	Core Major X		Plant Biotechnology	4	25	75	100
24.		I	Core Elective V		Pharmacognosy	3	25	75	100
25.		I	Core Major Practical-IV	PPB/CP/4004	Covering Paper IX & X	4	40	60	100
26.		I	Project	PPB/PR/4001	**Project**	4	20	80	100
27.		II	Soft Skills	SSD	Life and Managerial Skills	2	20	80	100
TOTAL MARKS					**MAJOR – 400; ELECTIVE – 100**				

	Marks	**Credits**
Major/Elective/Extra Disciplinary	2200	81
Soft skills/Internship	400	10
Total	2600	91

Paper	Title of Paper
Core Major I	Algae, Fungi and Microbiology
Core Major II	Bryophytes, Pteridophytes, Gymnosperms and Paleobotany
Core Major III	Taxonomy of angiosperms and Economic botany
Core Major IV	Cell Biology
Core Major V	Plant Anatomy, Embryology and Palynology
Core Major VI	Genetics, Plant Breeding and Evolution
Core Major VII	Plant Tissue Culture
Core Major VIII	Ecology and Phytogeography
Core Major IX	Plant Physiology and Biochemistry
Core Major X	Industrial Biotechnology
ELECTIVE	
Core Elective I	Plant pathology (or) Biopesticide Technology
Core Elective II	Applications of Algae (or) Microbial technology
Core Elective III	Molecular biology and Genetic Engineering (or) Mushroom Cultivation and Marketing
Core Elective IV	Bioinstrumentation and Bioinformatics (or) Biostatistics
Core Elective V	Pharmacognosy (or) Ethnobotany
EXTRADISCIPLINARY	**OFFERED TO OTHER DEPARTMENTS**
Extradisciplinary I Extradisciplinary II	Basics of Bio Informatics **(M. Sc Statistics)** Basics of Bio Informatics (**M. Sc Physics)**
NON MAJOR ELECTIVE	**OFFERED BY OTHER DEPARTMENTS**
Non-major Elective I Non-major Elective II	Nanotechnology **(M. Sc Physics)** Data Analysis using SPSS **(M. Sc Statistics)**
***SOFT SKILL**	*** AFTER COLLEGE HOURS**
	Essentials of Spoken and Presentation Skills
	Essentials of Spoken and Presentation Skills Advanced Level
	Personality Enrichment
	Life and Managerial Skills

PATTERN OF QUESTION PAPER

Time : 3 hrs Max Marks: 75

SECTION – A

(10 x 2 = 20)

Answer any Ten Questions out of Twelve
(Questions must cover all the units)

1.
2.
3.
4.
5.
6.
7.
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11.
12.

SECTION – B

(5 x 5 =25)

Answer any five Questions out of Seven
(Questions must cover all the units)

13.
14.
15.
16.
17.
18.
19.

SECTION – C

(3 x 10 =30)

Answer any three Questions out of five
(Questions must cover all the units)

20.
21.
22.
23.
24.

ALGAE, FUNGI AND MICROBIOLOGY

SEMESTER I **Theory: 5 Hrs**
Core Major Paper-I **Practicals: 4 Hrs**
Credits: 4

Unit I:

Algae: Classification (F.E. Fritsch 1945). Molecular taxonomy of algae. Contributions of Indian algologists. Pigments, Flagella, Reserve food materials, Reproduction and Life cycles in algae.

Unit II:

General characterstics of **Cyanophyceae, Chlorophyceae, Phaeophyceae, Bacillariophyceae, Rhodophyceae.**

Structure, reproduction, life cycle of following genera:
Cyanophyceae - ***Lyngbya..***
Chlorophyceae - ***Hydrodictyon, Cladophora, Chara.***
Phaeophyceae - ***Dictyota, Padina***
Bacillariophyceae – ***Navicula.***
Rhodophyceae – ***Polysiphonia, Gracilaria***

Unit III:

Fungi: Classification, (Ainsworth) Heterothallism – Sexuality, Parasexuality – Sex hormones, Mushroom cultivation, Economic importance of fungi.

UNIT IV:

Structure, reproduction & Life cycle of the following genera:
Myxomycotina-***Plasmodiophora***
Mastigomycotina-***Saprolegnia***
Zygomycotina-***Rhizopus***
Ascomycotina- ***Agaricus***
Basidiomycotina-***Puccinia,***
Deuteromycotina- ***Colletotrichum***

Unit V:

Microbiology:, Classification (Bergy's Manual, 1984) and identification of microorganism. **Microorganisms - Bacteria:** Morphology and fine structure of Bacteria – Cultivation of Bacteria – Reproduction and Growth – Pure cultures and Cultural characteristics of Bacteria – Gram-Negative, Gram-Positive, Economic importance of bacteria. Virus- classification of plant virus, morphology and multiplication of plant viruses.

ALGAE, FUNGI AND MICROBIOLOGY

PRACTICALS

Algae:

1. Study of morphological & anatomical structures of genera mentioned in the theory.
2. Algal mixture – Identification.

Spotters

3. Ocular Micrometer.
4. Camera Lucida**.**
5. A study tour of 4-6 days Algal collection (Collection of not less than 5 specimens for submission)

Fungi:

1. Study of Morphological & Reproductive structures of genera mentioned in the theory.
2. Protocol for Mushroom cultivation.

Microbiology:

1. Preparation of media
2. Isolation and Enumeration of microorganisms from the given soil, air and water samples.
3. Pure culture of bacteria and fungi.
4. Bacterial staining(Gram staining).

SUGGESTED REFERENCES

1. Tortora, Case and Funke. 2000. Microbiology. Benjamin-Cummings Pub. Co.
2. Alcamo. 2000. Fundamental of Microbiology, Jones and Barlett. Pub.
3. Carole Caranta, Miguel A. Aranda, Mark Tepfer and J.J. Lopez-Moya. 2011. Recent Advances in Plant Virology. Caister Academic Press.
4. Bold H.C.& Wynne M.J. 1976 Introduction to Algae structure and reproduction. Prentice-hall.
5. Fritsch F.E. 1935 & 1945 Structure and reproduction in Algae Vol. I& II, Cambridge University press
6. Marris, I 1967 an introduction to the Algae Hatchinson University Lab
7. Presott G.W. 1970 How to know freshwater Algae W.C. Braun & Co.,
8. Round F.E. 1966 The Biology of Algae Edward Arnold
9. Dodge J.D. The fine structure of Algal cells. Academic press
10. Chapman F.G. & Chapman D.J. 1973 The Algae. McMillan & Co.,
11.. Desikachary T.V. 1972. Taxonomy and Biology of Blue Green Algae. University of Madras
12.. Dixon P.S. 1987 Biology of Rhodophyta
13. Smith & Wittick 1987 An introduction of Algae. Blackwell Publication
14.Ainsworth G.C., Sparraw F.K. & Sussman A.S. 1973. The Fungi Academic Press.
15.Alexpolus, C. Jan, C.W. Main 1997. Introduction to Mycology Wileys, New Delhi.
16.Burnett J.H. 1976. Fundamentals of Mycology. Arnold London.
17.Webster, J. 1988. The Fungi C.V.P. Cambridge
18.Day, P.K. 1974. Genetics of host parasite interaction S. Chand & Co.,
19.Baher K.F. & Cook R.J. 1974 Biological control of plant pathogens S. Chand & Co. Ltd.,
20. M.J. Pelczar, Roger D. Reid and E.C.S. Chan. 1977. Microbiology, TATA McGraw-Hill Publishing Company Ltd., New Delhi.
21. A. Mani, A.M. Selvaraj, L.M. Narayanan and N. Arumugam. 1985. Microbiology, SARAS Publications, Nagarcoil.
22.G.J. Tortora, B.R. Funke, C.L. Case. 2004. Microbiology An Introduction. Pearson Education (Singapore) Pte. Ltd., Indian Branch, New Delhi.
23.Buchanan and Buchanan. 1951. Bacteriology. Oxford. 1951.
24. R. E. F. Matthews. Diagnoses of Plant Viral Diseases. 1993. CRC Press.

BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

SEMESTER I
Core Major Paper-II

Theory: 5 Hrs
Practicals: 4 Hrs
Credits: 4

Unit I:

Bryophytes: General characters and classification of Crandall-Stotler and Stotler (2000), Structural organization and evolution of Gametophytes, Origin and evolution of Sporophytes, Economic importance of Bryophytes.

Structure, Reproduction and Life cycle of the following genera: ***Lunularia, Porella, Funaria***

Unit II:

Pteridophytes: General characters and classification of Reimer 1954. Apospory, Apogamy Heterospory and Stelar evolution.

Unit III:

Structure, Reproduction and Life cycle of the following genera: ***Psilotum, Selaginella, Angiopteris, Osmunda, Pteris*.**

Unit IV:

Gymnosperms: General characteristics and classification by K.R Sporne 1965. Economic importance of Gymnosperms. Structure, Reproduction and life cycle of ***Araucaria, Cupressus, Podocarpus, Ephedra,*** .

Unit V:

Paleobotany: Gondwana Flora of India. Contribution of Birbal Sahni to Paleobotany. Study of fossils in understanding evolution. Study of organ genera: ***Sphenophyllum***, ***Cordaites***.

BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

PRACTICALS

Bryophytes:

Morphological and anatomical study of genera mentioned in the theory.

Pteridophytes and Gymnosperms:

Morphological, Anatomical and Reproductive study of genera mentioned in the theory.

SUGGESTED REFERENCES

BECK, C.B. (Ed.). 1988. Origin and Evolution of Gymnosperms. Columbia University Press. New York.

BHATNAGAR, S.P., AND A. MOITRA. 1996. Gymnosperms. New Age International Publishers. New Delhi.

BIERHORST, D.W. 1971. Morphology of Vascular Plants. Macmillan Publishing Company. New York.

CHOPRA, R.N., AND P.K. KUMAR. 1988. Biology of Bryophytes. John Wiley. New York.

CHOPRA, R.S. 1975. Taxonomy of Indian Mosses. CSIR. New Delhi

DELEVORYAS, T. 1962. Morphology and Evolution of Fossil Plants. Holt, Rinehart and Winston. New York.

DYER, A.F., AND J.G. DUCKETT. 1984. The Experimental Biology of Bryophytes. Academic Press. London.

GANGULEE, H.C. 1985. Handbook of Indian Mosses. Amerind Pub. Co., New Delhi.

GENSEL, P.G., AND H.N. ANDREWS. 1984. Plant Life in the Devonian. Praeger Publishers. New York.

GIFFORD, E.M. AND E.S. FOSTER. 1989. Morphology and Evolution of Vascular Plants. Third Edition. W.H. Freeman and Company. New York.

GRAHAM, L.E. 1993. Origin of Land Plants. John Wiley & Sons, Inc. New York.

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JOHRI, B.M. 1994. Botany in India - History and Progress Vol - I Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi.

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KUBITZKI, K., K.U. KRAMER AND P.S. GREEN (Eds.). 1990. The Families and Genera of Vascular Plants - I: Pteridophytes and Gymnosperms. Springer - Verlag. Berlin.

MANICKAM, V.S. AND V. IRUDAYARAJ. 1992. Pteridophyte Flora of the Western Ghats, South India. B.I. Publications. New Delhi.

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RAVEN, P.H., R.F. EVERT, AND S.E. EICHHORN. 1992. Biology of Plants. Fifth Edition. Worth Publishers. New York.

SPORNE, K. R. 1974. The Morphology of Gymnosperms. B. I. Publications. New Delhi.

SPORNE, K. R. 1976. The Morphology of Pteridophytes. B.I. Publications. New Delhi.

SMITH, A.J.E. 1982. Bryophyte Ecology. Chapman and Hall. London.

STEWART. W. N. 1983. Paleobotany and the Evolution of Plants. Cambridge University Press, California.

VENKATACHALA, B.S., M. SHUKLA AND M. SHARMA. 1992. Plant Fossils - A Link with the Past. Pub. & Infn. Directorate. New Delhi.

WATSON, E.V. 1971. The Structure and Life of Bryophytes. Hutchinson and Co., (Publishers) Ltd. London.

PLANT PATHOLOGY

SEMESTER I **Theory: 4 Hrs**
Core Elective paper-I **Credits: 3**

Unit I

Scope and Significance of Plant pathology, classification of plant diseases, Koch's postulates. – A study of principles of plant infection – inoculum potential – infection and dissemination of pathogens.

Unit II

Important diseases of crop plants in India (Bacterial blight of Rice, Wilt of cotton, Late blight of Potato, Red rot of sugar cane) TMV, Plant disease control (physical, chemical, integrated and biological).

Unit III

Host-parasite interactions (Physiology of parasitism): Pathogenesis or Disease development, Plant-Parasite Relationship. Role of enzymes and toxins in disease development. Defense mechanisms: Host defense – Structural defense, Biochemical defense.

Unit IV

Genetics of plant disease: Disease Resistance – Genetics of virulence and resistence, Gene-for-gene concept, Techniques in plant breeding for disease resistance. Genetics of Host-parasite interaction – mutation, heterokaryosis, parasexual recombination.

Unit V

Molecular Plant Pathology: Detection of pathogens in host tissues - ELISA and PCR-Incorporation of resistant gene by different methods (direct and indirect). .

SUGGESTED REFERENCES

1. Rangaswami, G. and A. Mahadevan. 1999. Diseases of Crop Plants in India. IV ed. Prentice Hall.
2. Mehrotra, R.S. 1980. Plant Pathology, Tata – MC Graw Hill Publishing Co. Ltd.
3. Dasgupta, M.K. 1988. Principles of Plant Pathology, Allied Publ. Pvt. Ltd.
4. Singh, R.S. 1983. Plant diseases, Oxford & IBH Publishing Co.
5. Bilgrami, K.S. and Dube, H.C. 1976. A Text book of Modern Plant Pathology. Vikas Publishing House Pvt. Ltd.
6. Walker, J.C. 1969. Plant Pathology – Tata MC Graw Hill Publishing Co. Ltd.
7. Hussain et al. Ed. 1983. Recent Advances in Plant pathology. Print House India.
8. P. Vidyasekharan. Principles Of Plant Pathology. 2014. 01 Edition. CBS Publishers & Distributors.

APPLICATION OF ALGAE

SEMESTER I **Theory:4 Hrs**
Core Elective II **Credits: 3**

UNIT - I

Historical perspective of use of algae for human needs; algae as Nutraceuticals; Chemical constituent of *Spirulina*, its vitamin and mineral content; chemical constituent of *Chlorella*. Biofertilizers; Structure and functions of heterocysts; Significance of using bluegreen algal fertilizers, Role of algae in Aquaculture.

UNIT – II

Industrial uses of algae: Structure, source, extraction and uses of Agar-agar, carrageenin and alginic acid. Liquid seaweed fertilizers – preparation, composition and uses.

UNIT - III

Cultivation of macroalgae: Macro-algal cultivation in India. Rope cultivation, net cultivation and raft cultivation. Immobilization, genetic engineering and biotic importance of Algae. National laboratories involved in marine algal cultivation.

UNIT - IV

Mass cultivation of microalgae: Mass culture of *Spirulina* and *Haematococcus*: Composition of medium, techniques involved in their culture, harvest. Indian centers cultivating microalgae.

UNIT – V

Importance of algae in fisheries; parasitic algae; algae in medicine: Therapeutic uses of algae and Role of algae in Nanotechnology. Aquatic pollution – causes and consequences:- Algae as pollution indicators; Phycoremediation.

SUGGESTED REFERENCES

1. DIXON, B.S. 1973. Biology of the Rhodophyta. Oliver and Boyd. Edinburgh.

2. FRITSCH, F.E. 1935. Structure and Reproduction of Algae. Vol.I. Cambridge University Press. Cambridge.

3. FRITSCH, F.E. 1945. Structure and Reproduction of Algae. Vol.II. Cambridge University Press. Cambridge.

4. GRAHAM, L.E. 1993. Origin of Land Plants. John Wiley and Sons. Inc. New York.

5. LEMBI, CAROLE,A. and J. ROBERT WAALAND . 1988. Algae and human affairs. Cambridge University Press. Cambridge.

6. LOBBAN, C.S., AND M.J. WYNNE (Eds.). 1981. The Biology of Seaweeds. Blackwell Scientific Publications. Oxford.

7. PARKER, S.P,(Ed.). 1982. Synopsis and Classification of Living Organisms. McGraw-Hill Book Company. New York.

8. SOUTH, G.R., AND A. WHITTICK. 1987. Introduction to Phycology. Blackwell Scientific Publications. Oxford.

TAXONOMY OF ANGIOSPERMS AND ECONOMICBOTANY

SEMESTER II **Theory: 5 Hrs**
Core Major Paper- III **Practicals: 4 Hrs**
Credits: 4

Unit I:

Systems of classification – Hutchinson,Cronquist and APG - Merits and demerits. Modern trends in taxonomy – Numerical taxonomy, Chemotaxonomy and Molecular taxonomy, Botanical Survey of India – Its organisation and role, Binomial Nomenclature, Taxonomic hierarchy, techniques in herbarium preparation, ICBN, Key preparation..

Unit II:

Study the following families & Economic uses; Menispermaceae, Portulaceae, Tiliaceae, Sapindaceae, Combretaceae, Rosaceae and Cucurbitaceae

Unit III:

Study the following families & Economic uses; Turneraceae, Molluginaceae, Oleaceae, Boraginaceae, Bignoniaceae, Euphorbiaceae and Verbenaceae.

Unit IV:

Study the following families & Economic uses; Casuarinaceae, Commelinaceae, Cannaceae, Orchidaceae, Amaryllidaceae and Cyperaceae.

Unit V:

Economic Botany – Detailed study of occurrence, mode of cultivation, biochemical and nutritional values of the following crop plants with their botanical details - Cereals and Millets - Rice, Maize; Pulses: Black gram; Sugar yielding plants: Sugarcane; Plantation crops: Coconut; Spices and condiments: Pepper; Tuber crops-: Tapioca; Narcotics: Cannabis.Timber yielding plants: Teak Wood; Fibre yielding –Cotton.

TAXONOMY OF ANGIOSPERMS AND ECONOMICBOTANY

PRACTICALS

1. Identification and Description of the given specimen at species and genus level using Flora.
2. Description of species for the families mentioned in the theory.
3. Key preparation using plants mentioned in theory (Bracketed & Intended)
4. ICBN Problems.
5. Field visits.
6. Submission of 25 herbarium sheets representing the families studied.

SUGGESTED REFERENCES

AHMEDULLAH, M., AND M.P. NAYAR. 1987. Endemic Plants of the Indian Region. Vol. I. Botanical Survey of India. Howrah.

CRONQUIST, A. 1968. The Evolution and Classification of Flowering Plants. Houghton Mifflin. Boston.

DAVIS, P.H., AND V.H. HEYWOOD. 1965. Principles of Angiosperm Taxonomy. Oliver & Boyd. Edinburgh.

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GAMBLE, J.S., AND C.E.C. Fischer. 1967. Flora of the Presidency of Madras. Vols. I - III. Botanical Survey of India. Calcutta.

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GROOMBRIDGE, B, (Ed.). 1992. Global Biodiversity: Status of The Earth's Living Resources. Chapman and Hall. London.

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JUDD, W. S, C. S. CAMPBELL, E. A, KELLOG, P. F. STEVENS AND N. J. DONOGHUE. 2002.Plant Systematics – A phylogenetic approach. Sinauer Associates, Inc, Massachusetts, USA

LAWRENCE, G.H.M. 1951. Taxonomy of Vascular Plants. The Macmillan Company. New York.

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MOORE, R., W.D. CLARK, K.R. STERN AND D. VODOPICH. 1995. Botany : Plant Diversity. Wm. C. Brown Publishers. London.

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SOLTIS, D. E., P. S. SOLTIS, P. K. ENDRESS AND M. W. CHASE.2005. Phylogeny and Evolution of Angiosperms. Sinauer Associates, Inc, Massachusetts, USA.

SIMPSON, M. G. 2006. Plant Systematics. Elsevier Academic Press, California, USA.

SIVARAJAN, V.V. 1989. Introduction to Principles of Plant Taxonomy. Oxford and IBH Publishing Co. New Delhi.

STACE, C.A. 1989. Plant Taxonomy and Biosystematics. Edward Arnold, London.

STUESSY, T. F. 2002. Plant Taxonomy. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.

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TAKHTAJAN, A. 1997.Diversity and Classification of Flowering Plants. Bishen Singh and Mahendra pal Singh, Dehra Dun, India.

CELL BIOLOGY

SEMESTER II
Core Major Paper - IV

Theory: 5 Hrs
Practicals: 4 Hrs
Credits: 4

Unit I:
Plasma membrane structure and function, structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channel, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport,electrical properties of membranes.

Unit II:
Structural organization and function of intracellular organelles Cell Wall, Endoplasmic reticulum , Dictyosomes , Lysosomes ,Glyoxysomes, Peroxisomes, vacuoles and Ribosomes. Structure and function of cytoskeleton.

Unit III:
Mitochondria,Nucleus and Chloroplast – Ultrastructure, and function of Mitochondrial and chloroplast DNA, Isolation and quantification of Nucleic Acid.

Unit IV:
Cell division and Cell cycle: Mitosis and Meiosis, their regulation,steps in cell cycle, regulation and control of cell cycle.

Unit V:
Chromosomes- morphology,fine structure- telomere- types: lamp brush ,polytene, isochromosome, heterochromatin and euchromatin, chromosome identification,- banding technique- chromosome aberrations- gene structure- transposons.

PRACTICALS

1. Study of dividing cells – squash and smears techniques (Mitosis and Meiosis).

SUGGESTED REFERENCES

1. Brown W.V. and Bertke.E.M., 1974, A text book of Cytology C.V.Mosley Co.,St. Louis
2. Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr. 2008. Cell Biology and Genetics. Cengage Learning.
3. Cohn.N.S., 1979, Elements of Cytology, Freeman Book Co.,
4. De Robertis& De Robertis. 1990. Cell and Molecular Biology, Saunders College,
5. De Robritis E.D.P. and DeRobrities. E.M.F.jr 1987 – Cell and Molecular biology Lea and Febiger..
6. Feifelder.D., - Molecular Biology, Narosa. Publication
7. Freifelder, D.1987. Essentials of Molecular Biology, Jones & Bartlett, Boston.
8. Gardner, EJ., Simmons, MJ. &Snustad, D. 1991. Principles of Genetics, John Wiley Sons Inc., 8th Edn., New York.
9. Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK
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PLANT ANATOMY, EMBRYOLOGYAND PALYNOLOGY

SEMESTER II **Theory: 4 Hrs**
Core Major Paper-V **Practicals: 4 Hrs**
Credits: 4

Unit I:

Organization & theories regarding shoot (Apical cell theory, Tunica corpus theory, Histogen theory), Root (Histogen, Korper-kape theory) and reproductive meristems (Tunica corpus, Mantle and Core).
Meristems and Differentiation: Meristems and Matured tissues. Classification of meristems, Growth patterns and differentiation in meristems.

UNIT II:

Vascular cambium - Structure & Significance of storied & non-storied cambium. Factors affecting cambial activity.
Xylem: Differentiation, xylary elements – maceration technique-tracheids, vessels, fibre and parenchyma. Patterns of secondary wall. Tyloses; reaction wood, heart wood and sap wood, Growth rings.
Phloem: Primary and secondary elements – ontogeny – differentiation. Structural variation, characteristics of phloem components.

UNIT III :

Nodal anatomy: Leaf traces and leaf gaps. Branch traces and branch gaps, closing of leaf gaps.
Stelar system – Types of stele.
Floral anatomy – Structure, arrangement of floral parts, vascular system, petal, sepal, stamen, pollen, carpel and ovule. Organogenesis and histogenesis.

UNIT IV:

Embryology: Microsporogenesis and Megasporogenesis – Structure, Process of fertilization in Angiosperms, Embryosac – Structure and types, Types of endosperm and Polyembryony.
Self-incompatibility, Genetic basis of self-incompatibility, Barriers to fertilization, Significance of Incompatibility, Methods to overcome incompatibility.

UNIT V:

Palynology: Pollen architecture, Pollen transfer, Pollen – pistil interaction. Methods of pollination. Aeropalynology – pollen allergy, palynological calendars, pollen analysis of honey..

PLANT ANATOMY, EMBRYOLOGY AND PALYNOLOGY

PRACTICALS

PLANT ANATOMY

Techniques in making temporary microscopic preparations - free hand sections, peeling, vein clearing, maceration.
Permanent slides using microtome (submission of 5 slides)
Anomalous secondary growth *Boerhavia*, *Dracena*, *Nyctanthus*
Wood sections – T.S, T.L.S, R.L.S.

EMBRYOLOGY

Anther section, Preparation of dissected whole mount of embryo.

PALYNOLOGY

Pollen analysis of honey

Study of pollen (acetolysis or non acetolysis).

SUGGESTED REFERENCES

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10. Knox R.B. 1980. Pollen and Allergy. Arnold – Heinemann.

11. Nair, P.K.K. 1985. Essentials of palynology.

12. S.N. Pandey and A. Chadha. 1997. Plant Anatomy and Embryology. Sangam Books Ltd.

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MOLECULAR BIOLOGY AND GENETIC ENGINEERING

SEMESTER II **Theory: 4 Hrs**
Core Elective Paper-III **Credits: 3**

Unit I:

Scope of molecular biology – Nucleic Acids – Base pairing and variations in base composition – Types of DNA, Chargaff's rule – DNA size – fragility – hydrophobic interactions – denaturation, Circular and superhelical DNA – Topoisomerase – special base sequence – Repeated sequence – Single stranded DNA – DNA methylation, structure of RNA.

Unit II:

Gene concept – fine structure – split gene – exons and introns. Gene function DNA replication – DNA Polymerase, Ligase, Helicase – Termination of DNA replication – Mismatch repair – Transcription in Prokaryotes – RNA polymerase – classes of RNA molecules – Transcription in Eukaryotes – splicing mechanisms – Reverse transcriptions. Translation, overlapping genes.

Unit III:

Types of vectors –Plasmid, PBR322 and its derivatives – gene markers, phage and cosmid vectors, artificial chromosome vectors : BAC & YAC, shuttle vectors and expression vectors.

Unit IV:

Cloning strategies: Recombinant DNA technology, Restriction enzymes for cloning, restriction mapping, construction of chimeric DNA. Construction of genomic and cDNA libraries. Recombinant DNA technologie. Intellectual Property Rights (IPR) and patents, Biosafety of GMO and GMPs

Unit V:

Southern, Northern and Western Blotting, Dot and Slot blots; Antisense RNA technology, DNA finger printing and DNA foot printing, RAPD, RFLP, Basic PCR principles and applications, RT PCR, anchored PCR, Real Time PCR, Q-PCR, Multiplex PCR, Sequencing methods, Chromosome walking and jumping.

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2. SOBTI R.C. and GOBE. 1991. Eukaryotic chromosomes. Narosa Publishing House.
3. SMITH-KEARY,P. 1991. Molecular Genetics. Macmillan Pub. Co. Ltd. London.
4. SUZUKI,D.T. *et al.* 1986. An introduction to genetic analysis. Third Edition. W.H. Freeman & Co.
5. WATSON,J.D. *et al.* 1987. Molecular Biology of the Gene. Fourth Edition. The Benjamin Cummings Pub. Co.
6. Brown, T.A. 2001. Gene Cloning and DNA Analysis, 4th edition, Black Well Science.
7. Cibelli, J.R.P., Lanza, K.H.S., Campbellel and M.D. West. 2002. Principles of Cloning, Academic Press.
8. Date, J.W. and M.V. Schantz, 2002. From genes and genomes. John Wiley and Sons Ltd.
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10. Primrose, S., R. Twyman and B. Old. 2001. Principles of gene manipulation, Blackwell Science Ltd., USA.
11. Watson, J.D., M. Jilman,J. Witkowski and M. Zoller., 2001. Recombinant DNA, Scientific American Books, USA.
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13. Setlow. 1994. **Genetic Engineering**: Principles And Methods (Volume 16) 1st Edition. **Publisher:** Plenum Publishers.
14. K Rajagopal. 2012. Recombinant DNA Technology and **Genetic Engineering**, 2012 . **Publisher:** Tata McGraw - Hill Education.
17. P S Verma. 2010. **GENETIC ENGINEERING**. **Publisher:** S CHAND & COMPANY-NEW DELHI
18. **Genetic Engineering**: Principles and Methods, 2012. **Publisher:** Springer.

BASICS OF BIOINFORMATICS

SEMESTER II **Theory: 4 Hrs**
Extradisciplinary-I **Credits: 3**

Unit I:

Bioinformatics: Introduction; Importance and Scope of Bioinformatics. Terminologies: Bioinformatics – definition, NCBI, Nucleic Acids, DNA, RNA, Genes, Genome.

Unit II:

Database Access and Records Retrieval.
Biological Databases:
Primary Databases;
Nucleic Acid Databases (EMBL, Genbank), Protein Databases (SWISS-PROT, PDB).
Secondary Databases (PROSITE)

Unit III:

Similarity Searching Tools – FASTA and BLAST Algorithm.

Unit IV:

Introduction to Drug discovery: Pharmacogenomics and Pharmacogenetics and its applications.

BASICS OF BIOINFORMATICS

PRACTICALS

1. Database Access and Records Retrieval

    -Retrieval of Nucleotide sequence using Genbank.
    - Retrieval of Protein sequence using Uniprot.
    -Retrieval of Protein structure using PDB.
    -Translation of DNA sequencing using Expasy.

2. Sequence Comparison/Alignment.
    -Sequence similarity search using BLAST.
    - Sequence similarity search using FASTA.

SUGGESTED REFERENCES

1. Brown, T.A. 2001. Gene Cloning and DNA Analysis, 4th edition, Black Well Science.

2. Cibelli, J.R.P., Lanza, K.H.S., Campbellel and M.D. West. 2002. Principles of Cloning, Academic Press.

3. Date, J.W. and M.V. Schantz, 2002. From genes and genomes. John Wiley and Sons Ltd.

4. Old., R.W. and Primrose, S.B. 1998. An introduction to genetic engineering, Principles of gene manipulation, Blackwell Science, Germany.

5. Primrose, S., R. Twyman and B. Old. 2001. Principles of gene manipulation, Blackwell Science Ltd., USA.

6. Watson, J.D., M. Jilman,J. Witkowski and M. Zoller., 2001. Recombinant DNA, Scientific American Books, USA.

7. Baxevanis, 1998. Bioinformatics

8. Higgins and Taylor, OUP. 2000. Bioinformatics

9. Brown, T.A. 2001. Gene Cloning and DNA Analysis, 4th edition, Black Well Science.

10 . Rastogi, S.C., N. Mendiratta, P. Rastogi. 2007. Bioinformatics Methods and Applications. Second Edition, Prentice Hall India Private Limited, New Delhi.

PATTERN OF QUESTION PAPER

Time : 3 hrs **Max Marks: 60**

SECTION – A
(1 x 10 = 10)

Answer any Ten Questions out of Twelve:

1.
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SECTION – B
(5 x 4 = 20)

Answer any Four questions out of Five:

13.
14.
15.
16.
17.

SECTION – C
(3 x 10 = 30)

Answer any Three questions out of Four:

18.
19.
20.
21.

GENETICS, PLANT BREEDING AND EVOLUTION

SEMESTER III
Core Major Paper - VI

Theory: 4 Hrs
Practicals: 3 Hrs
Credits: 4

Unit I:

Mendelian Genetics: Mendel's experiments,Monohybrid and Dihybrid cross, Back cross, genetic ratios, Mendelianinheritance, Law of segregation, Independent Assortment.

Unit II:
Concept of genes: Allele, multiple alleles,pseudoalleles. Extension ofMendelian principle.Co-dominance, Incomplete dominance, gene interaction, Epistasis, multiple alleles, lethal genes.

Unit III:
Linkage and Crossing over, Chiasma frequency –gene mapping, tetrad analysis. Sex determination in plants, sex linkage – dominant and recessive sex linked genes – holandric genes. Sex linked diseases – haemophilia, colour blindness – Pedigree chart.

Unit IV:
Plant Breeding : Principles involved in Plant Breeding and its importance in green revolutgion with reference to wheat, rice, sugarcane, maize and cotton. Methods of crop improvement: Selection (pure line, mass and clonal), hybridization, introduction and acclimatization- heterosis – causes and effects. Polyploidy in Plant Breeding – Breeding for disease restance, improved seed production and seed testing techniques.

Unit V:
Evolution : Evolution – origin of life- theories of evolution Darwin, Lamark and De veries, Modern synthetic theory, variation- adaptation and selection.

PRACTICALS

Genetic Problems

SUGGESTED REFERENCES

1. Benjamin Lewin (2010), Genes X, Oxford University Press, USA. WEBSITE:
2. Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr. 2008. Cell Biology and Genetics. Cengage Learning.
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4. E.J. Gardner, M.J.Simmons, D.P.Snustad2001. Principles of Genetics,8thedition, John Wiley and Sons, Inc., New Jersey, USA.
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9. Hartl, D. L. and Jones, E.W 2005. Genetics: Analysis of genes and genomes,
10. Lewin, B. 1994. Genes V. Oxford University Press. New Delhi.
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13. Prasad, S. 1992. Fundamentals of Biostatistics (Biometry). Emkay Pub. DelhiNew Delhi.
14. Robert.H.Tamarin, 2002, Principle of Genetics, 7thedition, Tata McGraw Hill, New Delhi.
15. Smith-keary,P. 1991. Molecular Genetics. Macmillan Pub. Co. Ltd. London.
16. Sobti R.C. and Gobe. 1991. Eukaryotic chromosomes. NarosaPub¬lishing House.
17. Speigels, M.R. 1972. Theory and Problems of Statistics. Shaum's Outline Series. McGraw Hill Book Co. Singapore.
18. Strickberger M.W 2003. Genetics, 3rdedition. Prentice- Hall of India Pvt Ltd.,
19. Strickberger,M.W.1990. Genetics. Third Edition. Macmillan Pub¬lishing Company.
20. Suzuki,D.T. et al. 1986. An introduction to genetic analysis. Third Edition. W.H. Freeman & Co.
21. Watson,J.D. et al. 1987. Molecular Biology of the Gene. Fourth Edition. The Benjamin Cummings Pub. Co.

PLANT TISSUE CULTURE

SEMESTER III **Theory: 4 Hrs**
Core Major Paper-VII **Practicals: 3 Hrs**
Credits: 4

Unit – I:

Tissue culture: Milestones in tissue culture of plants. Concept of totipotency. Sterilization Procedures – Fumigation, wet and dry sterilization, ultraviolet sterilization, ultra filtration and surface sterilization. Design of laboratory, R & D and commercial tissue culture facility.

UNIT – II

Tissue culture: Media for ***in vitro*** culture; Types of media – Solid, liquid and commercial prepacked media; Media composition – Macronutrients, Micronutrients and plant growth regulators (PGRs); Preparation of media; Selection of suitable media.

UNIT - III.

Explants for Tissue Culture: Shoot tip, axillary buds, leaf discs, cotyledons, inflorescence and floral organs. Callus culture - initiation and maintenance of callus. Micropropagation - direct and indirect morphogenesis, somatic embryogenesis and synthetic seed production.

UNIT – IV

Suspension Culture - Culture systems, Isolation of single and aggregate of cells and regeneration of plants; Immobilization of cells and use of bioreactors.
Protoplast Culture - Isolation of protoplast, culture of protoplast, regeneration and sub-protoplast; Somatic cell hybridization, selecting desired hybrids and their regeneration into plants.

UNIT - V

Crop improvement in tissue culture: Mericulture –production, virus free plants, production of clones, cell culture and production of secondary metabolites, protoplast as a tool in biotechnology, breaking self incompatibility by embryo culture.

PLANT TISSUE CULTURE

PRACTICAL

1. Laboratory Techniques –

   Cleaning and sterilization of Glassware's

   Surface Sterilization

   Inoculation (Laminar Air flow Chamber)

2. Preparation of MS and White's media.

3. Culture of excised leaves and shoot tips.
   1. Callus Culture
   2. Axillary Bud Culture
   3. Leaf Disc culture
   4. Shoot tip culture
   5. Anther culture
   6. Cotyledon culture
   7. Embryo culture

SUGGESTED REFERENCES

1. AMMIRATO, P.V., D.A EVANS, W.R. SHARP., and Y.P.S. BAJAJ 1990. Hand Book of Plant Cell Culture. Vol 5. Ornamental Species. McGraw Hill Publishing Company. New York.

2. BENCOCHEA, T., AND J.H. DODDS. 1986. Plant Protoplasts. A Biotechnological Tool for Plant Improvement. Chapman and Hall. London.

3. BUTCHER, D.N., and D.S. INGRAM. 1982. Plant Tissue Culture. Oxford. IBH Publishig Company. Delhi.

4. BUTENKO, R.G. 1985. Plant Cell Culture. MIR Publishers. Moscow.

5. DEBERG, P.C., AND R.H. ZIMMERMANN. 1981. Micropropagation-Technology and Application. Kluwer Academic Publishers. London.

6. DIXON, R.A. 1985. Plant Cell Culture. A Practical Approach. IRL, Press. Oxford. London.

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9. NARAYANASWAMY, S. 1994. Plant Cell and Tissue Culture. Tata Mc Graw - Hill Publishing Company Limited. New Delhi.

10. REINERT, J., AND Y.P.S. BAJAJ. I977. Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Springer-Verlag. Berlin.

11. REINERT, J., AND YEOMAN. 1988. Plant Cell and Tissue Culture - A Laboratory manual.

12. REINHARD, B.E., AND M.H. ZENK. 1977. Plant Tissue Culture and its Biotechnological Application.

13. TREVAN, M.D., S. BOFFEY, K.J. GOULDING, AND P. STANBURG. 1977. Biotechnology: The Biological Principles. Tata McGraw Hill Publishing Company Limited. New Delhi.

14. Seema Srivastava S. K. Singh. 2012. **Plant Tissue Culture**, 01 Edition. **Publisher:** Neha Publishers & Distributors .

ECOLOGY AND PHYTOGEOGRAPHY – PPB/CT/3009

SEMESTER III
Core Major Paper - VIII

Theory: 4 Hrs
Practicals: 3 Hrs
Credits: 4

UNIT I

Ecosystem Ecology: Concept of Ecology and Ecosystem; Kinds of ecosystem – Natural and Artificial; components of ecosystem – Biotic and Abiotic; Types of ecosystem – Pond, Lake, Ocean, Grassland, Forest and Desert Ecosystem.

UNIT II

Energy Flow: Energy flow in an ecosystem- food chain, food web, tropic level (pyramids), Types of energy flow models; Study of Nutrient cycles (Biogeochemical Cycles) – Atmospheric cycle (Hydrological and carbon cycle) and Edaphic Nutrient cycle (Nitrogen and Phosphorus cycle).

UNIT III

Global Warming: Green House Effects – Causes and consequences – Carbon dioxide and carbon monoxide as pollutants – Depletion of Ozone Layer – Threats to ozone protector – Global efforts to save ozone layer ; Biological Monitoring Programmes.

UNIT IV

Community Ecology: Definition; Components of a Community - Composition, structure, origin and development of a community – Characters used in community structure – Methods of study of communities – Units of vegetation – Classification of community - Clemantsian units of vegetation - Main concepts of communities. Basics of population ecology.

UNIT V

Phytogeography – Definition - Distribution patterns - age and area hypothesis; Continental Drift – Major plant communities of world – Phytogeographic regions of world (Vegetation Belts) – Soils of India – Climatic regions of India – Floristic / Botanical regions of India – Vegetation of India, Remote sensing.

ECOLOGY AND PHYTOGEOGRAPHY

PRACTICALS

1. Types of Ecosystem – Pond, Lake, Ocean, Forest, Desert and Grassland,

2. Types of Energy Flow Models – single, Y channel, Hydrological cycle, Carbon cycle, Nitrogen cycle and Phosphorus cycle.

3. Green House Effect - Carbonmonoxide, Carbondioxide,. Ozone layer.

4. Determination of the qantitative characters of a plant community by Random Quadrat Method, Belt Transect Method and Line Transect Method and calculate the Abundance, Density and Frequency.

5. Mapping - Soil types in India (Alluvial soil, Black soil, Red soil, Skeletal mountain soil, Desert soil, ad laterite soil).

6. Mapping – Floristic/ Botanical regions of India (Western Himalayas, Eastern Himalayas, Gangetic plains, West Indian Desert/ Indus plain, Assam, Central India, Malabar, The Deccan, Andamans).

SUGGESTED REFERENCES

BEGON, M., J.L. HARPER, AND C.R. TOWNSEND. 1990. Ecology: Individuals, Population and Communities. Second edition. Blackwell Scientific Publications. London.

CURREN, P. 1983. Principles of Remote Sensing. ELBS Edition, U.K.

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GADGIL, M., D. PRESTON, AND P.R.S. RAO. 1995. A Comprehensive Framework for nurturing Practical Ecological Knowledge. Centre of Ecological Studies, Indian Institute of Science, Bangalore, India.

GADGIL, M AND MEHER-HOMJI. 1990. 'Ecological Diversity'. In J.C. Daniel and J.S. Serrao: Conservation in Developing Countries: Problems and Prospects. BHS and Oxford Univ. Press, Bombay.

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KOTHARI, A. 1997. Understanding Biodiversity - Life, Sustainability and Equity. Tracts for the times. Orient Longman, New Delhi.

LARCHER, W. 1983. Physiological Ecology of Plants. Springer - Verlag, New York.

LEVINE, J.S., AND R.M. KENNETH. 1992. Biology: Vol.1. Core Concepts. D.C. Heath and Company, Lexington, U.S.A.

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PURI, G.S., V.M. MEHER-HOMJI, R.K. GUPTA, AND S. PURI. 1983. Forest Ecology. Vol.1. Oxford & IBH Publishing Co. New Delhi. India.

RAMPAL, K.K. Text Book of Photogrammetry. Oxford & IBH Publishing Co. New Delhi. India.

SALISBURY, F.B. AND C.W. ROSS. 1986. Plant Physiology. Third Edition. CBS Publishers and Distributors. New Delhi. India.

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WORLD CONSERVATION MONITORING CENTRE. 1992. Global Biodiversity: Status of the Earth's Living Resources. Chapman and Hall. London.

WWF AND IUCN. 1994-1995. Centres of Plant Diversity: A Guide and Strategy for their Conservation. Volume 1-3. IUCN Publication Unit. Cambridge. UK.

WYMAN, R.L. 1991. Global Climate Change and Life on Earth. Routledge. Chapman and Hall Inc. New York.

BIOINSTRUMENTAION AND BIOINFORMATICS

SEMESTER III **Theory: 4 Hrs**
Core Elective paper-IV **Credits: 3**

Unit I:

Separation techniques: centrifugation, ultrafiltration, dialysis and Electrophoresis – Native and SDS PAGE, Chromatographic techniques -Paper chromatography, Thin Layer Chromatography (TLC), High Performance Thin Layer Chromatography (HPTLC), High Performance Liquid Chromatography (HPLC), Column chromatography and Gas Chromatography.

UNIT - II

Spectroscopic techniques: Colorimetry, UV-Visible Absorption Spectrophotometry, Infra Red Spectrophotometry, Mass Spectrophotometry, NMR Spectrophotometry and Fluorescent Spectroscopy.

Unit III

Microscopy: Light Microscopy, Dark-field, Phase contrast, Polarized light, Interference contrast (Nomarski) and Fluorescence Microscopy. Scanning and Transmission Electron Microscopy, Confocal Laser Scanning Microscopy, Photography – Micro and Macrophotography.

Unit IV

Scope of Bioinformatics: Sequence analysis – Homology & Analogy – National center for biotechnology & information (NCBI). Biological data bases – primary data base – Protein sequence data base – MIPS – SWISS PROT; Secondary data base – Prosites – Finger print data base; Genomics and Proteomics.

Unit V:

Phylogenetic analysis: Phylogenetic trees; Method of Phylogenetic Analysis - Phenetic and cladistics method of analysis – Introduction to Drug Discovery - Approaches to drug Discovery – Pharmacogenomics and Pharmacogenetics and its applications – Analysis of Single Nucleotide Polymorphism (SNP) - Process of Drug discovery**:** Target identification – Target Validation – Lead identification – Lead optimization – Preclinical pharmacology and Toxicology.

SUGGESTED REFERENCES

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2. ROBINSON, P.C. 1992. Qualitative polarized light microscopy. Royal Microscopical Society. Oxford University Press. U.K.

Brown, T.A. 2001. Gene Cloning and DNA Analysis, 4th edition, Black Well Science.

Cibelli, J.R.P., Lanza, K.H.S., Campbellel and M.D. West. 2002. Principles of Cloning, Academic Press.

Date, J.W. and M.V. Schantz, 2002. From genes and genomes. John Wiley and Sons Ltd.

Old., R.W. and Primrose, S.B. 1998. An introduction to genetic engineering, Principles of gene manipulation, Blackwell Science, Germany.

Primrose, S., R. Twyman and B. Old. 2001. Principles of gene manipulation, Blackwell Science Ltd., USA.

Watson, J.D., M. Jilman,J. Witkowski and M. Zoller., 2001. Recombinant DNA, Scientific American Books, USA.

Baxevanis, 1998. Bioinformatics

Higgins and Taylor, OUP. 2000. Bioinformatics

Brown, T.A. 2001. Gene Cloning and DNA Analysis, 4th edition, Black Well Science.

Rastogi, S.C., N. Mendiratta, P. Rastyogi. 2007. Bioinformatics Methods and Applications. Second Edition, Prentice Hall India Private Limited, New Delhi.

BASICS OF BIOINFORMATICS

SEMESTER III **Theory: 4 Hrs**
Extradisciplinary II **Credits: 3**

Unit I:

Bioinformatics: Introduction; Importance and Scope of Bioinformatics. Terminologies: Bioinformatics – definition, NCBI, Nucleic Acids, DNA, RNA, Genes, Genome.

Unit II:

Database Access and Records Retrieval.
Biological Databases:
Primary Databases;
Nucleic Acid Databases (EMBL, Genbank), Protein Databases (SWISS-PROT, PDB).
Secondary Databases (PROSITE)

Unit III:

Similarity Searching Tools – FASTA and BLAST Algorithm.

Unit IV:

Introduction to Drug discovery: Pharmacogenomics and Pharmacogenetics and its applications.

BASICS OF BIOINFORMATICS

PRACTICALS

1.Database Access and Records Retrieval

-Retrieval of Nucleotide sequence using Genbank.
- Retrieval of Protein sequence using Uniprot.
-Retrieval of Protein structure using PDB.
-Translation of DNA sequencing using Expasy.

2. Sequence Comparison/Alignment.
-Sequence similarity search using BLAST.
- Sequence similarity search using FASTA.

PATTERN OF QUESTION PAPER

Time : 3 hrs **Max Marks: 60**

SECTION – A
(1 x 10 = 10)

Answer any Ten Questions out of Twelve:

1.
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SECTION – B
(5 x 4 = 20)

Answer any Four questions out of Five:

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17.

SECTION – C
(3 x 10 = 30)

Answer any Three questions out of Four:

18.
19.
20.
21.

SUGGESTED REFERENCES

1. Brown, T.A. 2001. Gene Cloning and DNA Analysis, 4th edition, Black Well Science.

2. Cibelli, J.R.P., Lanza, K.H.S., Campbellel and M.D. West. 2002. Principles of Cloning, Academic Press.

3. Date, J.W. and M.V. Schantz, 2002. From genes and genomes. John Wiley and Sons Ltd.

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5. Primrose, S., R. Twyman and B. Old. 2001. Principles of gene manipulation, Blackwell Science Ltd., USA.

6. Watson, J.D., M. Jilman,J. Witkowski and M. Zoller., 2001. Recombinant DNA, Scientific American Books, USA.

7. Baxevanis, 1998. Bioinformatics

8. Higgins and Taylor, OUP. 2000. Bioinformatics

9. Brown, T.A. 2001. Gene Cloning and DNA Analysis, 4th edition, Black Well Science.

10. S.C. Rastogi, N. Mendiratta, P. Rastogi 2007. Bioinformatics Methods and Applications, Second Edition, Prentice Hall of India Private Ltd., New Delhi.

PLANT PHYSIOLOGY AND BIOCHEMISTRY

SEMESTER IV
Core Major Paper - IX

Theory: 5 Hrs
Practicals: 5 Hrs
Credits: 4

Unit I:

Plant Growth and Developments: Plant hormones (natural and synthetic, Plant growth regulators – Bioassay, biosynthesis and physiological actions of auxins, gibberellins, cytokinins, ethylene, ABA and Brassins.

UNIT - II

Primary metabolites: carbohydrates, protein and lipids. Secondary metabolites – Structure, Types, Sources, Biosynthesis and function of alkaloids, terpenoids and flavonoids.

UNIT – III

Enzymes – Nomenclature (recent) – Chemical nature –properties – Enzyme kinetics - Michaelis-Menten constant – Regulation of enzyme activity.

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UNIT – IV Photosynthesis: Plant pigment system: Absorption and action spectrum – Phosphorescence and fluorescence. Light reaction - Pathways of carbon fixation C_3, C_4 subtypes and CAM.

Photoperiodism: Critical day light – Photoperiodic induction – long and short day plants, Importance of photoperiod – Florigen – Phytochrmome – P_R and P_{FR} forms.

UNIT V:

Respiration: Aerobic respiration - Glycolysis and Kreb's cycle, chemiosmotic ATP synthesis. Anaerobic respiration – Pentose phosphate pathway; Oxidation of Lipids – α – oxidation, β – oxidation, w – oxidation and conversionof fats into carbohydrates (Glyoxylate cycle).

Nitrogen metabolism : Symbiotic and non – symbiotic N_2 fixation.

PLANT PHYSIOLOGY AND BIOCHEMISTRY

PRACTICALS

1. Preparation of Percentage solution
2. Quantitative estimation of protein (Bradford's method)
3. Quantitative estimation of carbohydrates(Duboi's Method)
4. Extraction and estimation of total lipids.
5. Estimation of total aminoacid.
6. Separation of photosynthetic pigments by paper chromatography
7. Separation of aminoacids using TLC
8. Separation of alkaloids by paper chromatography or TLC
9. Determination of α-amylase activity
10. Estimation of peroxidase activity
11. Estimation of catalase activity
12. Identification of C_3 and C_4 plants.
13. Determination of C_4 photosynthetic subtypes using anatomical criteria
14. Comparative rate of respiration by titration method
15. Effect of plant growth regulators on seed germination

SUGGESTED REFERENCES

1. BIDWELL, R.G.S. 1974. Plant Physiology. Macmillan Pub. Co., N.Y.

2. BONNER, J. AND J.E. VARNER. 1976. Plant Biochemistry. Academic Press.

3. BROWN, W.H. AND E.P. ROGERS. 1980. General Organic and Biochemistry. Willard Grant Press.

4. BUCHANAN, B. B., W. REUISSEM AND R. L. JONES. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologist, Rockwell, Maryland, USA.

5. CONN, E.E., AND P.K. STUMPF. 1976. Outlines of Biochemistry. Academic Press.

6. CONN,E.E., P.K. STUMPF, G. BRUENING AND R.H. DOI. 1987. Outlines of Biochemistry. John Wiley and Sons. New York.

7. DAVID, F. 1982. Physical Biochemistry. W.H. Freeman and Company. New York.

8. DAVID, F. 1987. Molecular Biology. Narosa Publishing House. New Delhi.

9. DENNIS, D.T. AND D.H. TURPIN, (Eds.). 1989. Plant Physiology, Biochemistry and Molecular Biology. Longman Scientific and Technical Publishers. U.K.

10. DEVLIN, R.M. AND F.H. WITHAM. 1983. Plant Physiology. Willard Grant Press. U.S.A.

11. HALL, D.O. AND K.K. RAO. 1994. Photosynthesis. Fifth Edition. Cambridge University Press. U.K.

12. HANS-WALTER HELDT. 1997. Plant Biochemistry and Molecular Biology. Oxford University Press, New York. USA.

13. MACMILLAN, J. 1980. Hormonal Regulation of Development. I. Molecular Aspects of Plant Hormones. Springer-Verlag. Berlin.

14. MOORE, T.C. 1979. Biochemistry and Physiology of Plant Hormones. Springer-Verlag. Berlin.

15. SALISBURY, F.B. AND C. ROSS. 1991. Plant Physiology. Wadsworth Publishing Company. Belmont.

16. STRYER, L. 1981. Biochemistry. W.H. Freeman and Company. New York.

17. Fundamentals of Plant Physiology, Dr. V.K.Jain, 2012, 2014.

PLANT BIOTECHNOLOGY

SEMESTER IV **Theory: 4 Hrs**
Core Major Paper X **Credits: 3**

Unit – I

Fermentation Technology: Sterilization procedure, components of media (Natural and Synthetic); Media (Substrates) for Industrial Fermentation. Bioreactors/Fermenter, Types of Bioreactors – Continuous stirred tank bioreactors, Bubble column bioreactors, Airlift bioreactors, Fluidized bed bioreactors, Packed bed bioreactors and Photobioreactors.

Unit – II

Microbial Metabolic Products: Primary metabolites – Vitamins, Secondary metabolites –, Alkaloids, Gibberellins, Pigments and Steroids. High molecular weight compounds – Diabetes mellitus – Insulin – Techniques for recombinant insulin production, Interferons – Mechanisms of action, production of recombinant interferons, therapeutic applications of interferons.

Unit – III

Enzyme Technology: Sources of Enzymes, Commercial production of enzymes – production process, isolation and purification of enzymes. Immobilisation of enzymes – Methods of immobilization, Microencapsulation, biosensors and types of biosensors. Industrial enzymes and therapeutic uses of enzymes.

Unit – IV

Microbial production: Organic solvents: Ethanol and Acetone; Antibiotics: Penicillin and Streptomycin; Amino acids: Lysine and Glutamic acid; Organic acids: Citric acid and Lactic acid.

UNIT – V

Microbial Production of Food: Fermented Foods, Advantages – Production process of Cheese, Bread and Yoghurt. Alcoholic beverages – Production process of Beer and Wine.

SUGGESTED REFERENCES

1. M.J. Pelczar, Roger D. Reid and E.C.S. Chan. 1977. Microbiology, TATA McGraw-Hill Publishing Company Ltd., New Delhi.

2. A. Mani, A.M. Selvaraj, L.M. Narayanan and N. Arumugam. 1985. Microbiology, SARAS Publications, Nagarcoil.

3. Alcamo. 2000. Fundamental of Microbiology, Jones and Barlett. Pub.

4. H.D. KUMAR and L.C. RAI. Microbes and Microbial Processes . Published by East-West Press Private Limited.

5. WILLIAM C.FRAZIER, DENNIS C. WESTHOFF. 2006. Food microbiology. 4th edition. Tata Mc Graw-Hill publications. New Delhi.

6. GERARD J.TORTORA, BERDELL R.FUNKE, CHRISTINE L.CASE 2005. Microbiology - - An introduction. 8th Edition.Published by Pearson Education (Singapore) Pte. Ltd.

7. PRAVE, P., *et al.* 1987. Fundamentals of Biotechnology. FDR.

8. PUROHIT, S.S., AND S.K. MATHUR. 1993. Fundamentals of Biotechnology. Agrobotanical Publishers. India.

9. TREVAN, M.D., S. BOFFEY, K.J. GOULDING, AND P. STANBURG. 1977. Biotechnology: The Biological Principles. Tata McGraw Hill Publishing Company Limited. New Delhi.

PHARMACOGNOSY

SEMESTER IV **Theory: 4 Hrs**
Core Elective Paper-V **Credits: 3**

UNIT I:

Introduction, historical background, present status and future of pharmacognosy and its relationship with other fields of study. Traditional system of medicines - Homeopathy, Siddha, Ayurvedic and Unani.

UNIT – II

Study of Crude Drugs – Crude drugs as pharmaceutical aids; its thereupatic uses; adulteration; Drug evaluation – organoleptic, microscopic, physical, chemical and biological evaluation; Storage of crude drugs; Marketing of drugs – dry, garbling and packing.

UNIT III

Chemical nature of natural Drugs - Classification, isolation and function of Alkaloids, Terpenoids, Glycosides, Volatile oils, Lipids, tannins, Resins and Carbohydrates.

UNIT IV

Grouping of Natural Drugs - Occurrence, distribution, organoleptic characters, chemical constituents and theureupetic uses.

1. Laxative – I*sphaghula*
2. Cardiotonics – *Digitalis*
3. Carmanatives – Nutmeg
4. Drugs acting on Nervous System – *Ashwaganda (Withania somnifera*)
5. Antihypertensive – *Rauwolfia serpentina*
6. Anticancer – *Taxus*

UNIT V

Grouping of Natural Drugs - Occurrence, distribution, organoleptic characters, chemical constituents and theureupetic uses.

7. Antitissive – Tulsi (*Ocimum sanctum)*
8. Antidiabetic – *Gymnema slyvestris*
9. Antimalarial – *Cinchona*
10. Antiseptic and Disinfectant – Turmeric (*Curcuma longa*)
11. Diuretic – *Tribulus terrestis*.
12. Antiviral – *Adhathoda*

SUGGESTED REFERENCES

Pharmacognosy by G.E. Trease, W.C. Evans, 1988.ELBS.

Pharmacognosy by Varro E.Tyler, Lynn. R.Brady, James E.Robbers.2000. McGaw Hill.

Text Book of Pharmacognosy by T.E. Wallis, CBS Pub. Delhi.

Indian Medicinal Plants by Kirthikar, Basu.

Indian Materia Medica by K.M. Nalkarni

Pharmacographia Indica by W.Dymock.

A Hand Book of Common remedies in Siddha system of medicine- CCRIMH.

Phytochemical methods of chemical analysis by Harbone.

Pharmacoepial standards for Ayurvedic formulations –CCRAS, Delhi.

Practical Pharmacognosy by Dr.C.K.Kokate.

Practical Pharmacognosy by Dr.P.K.Lala.

Bibiliography on pharmacognosy of medicinal plants-Roma Mitra.

Pharmacognosy and Pharmacobiotechnology – Ashutoshkar.

Foundations of Ayurveda – K.H.Krishnamurthy.

Homoeopathic pharmacy – Steven B.Kayne.

Dictionary of Indian Folk medicine and Ethnobotony – Dr.S.K.Jain.

LIST OF ELECTIVES

BIOPESTICIDE TECHNOLOGY

SEMESTER I **Theory: 4 Hrs**
Core Elective paper -I **Credits: 3**

Unit I

Introduction of Biopesticides, Advantages for the use of Biopesticides.

Unit II

Types of Biopesticides: Bioinsecticides, Biofungicides. Biobactericides, Bionamaticides and Bioherbicides.

Unit III

Important Biopesticides; *Bacillus thuringiensis*, NPV, entomopathogenic fungi (*Beauveria, Metarhizium, Verticillium*). Biofungicides: *Trichoderma, Gliocladum, Coniothyrium*. Biopesticides: *Agrobacterium radiobacter, Pseudomonas spp., Bacillus spp*. Bionematicides: *Trichoderma, Paecilomyces.* Bioherbicides: *Phytophthora, Colletotrichum*.

Unit IV

Target pest and crops of important biopesticides and their mechanism of action.

UnitV

Scope and future. - Applications and Benefits of Biopesticides,

SUGGESTED REFERENCES

1. Subba Rao, N.S. 2000 Soil Microbiology. Oxford and IBH Publishing Co. Ltd.
2. Webster, J. and Weber, 2007. Introdection to Fungi, 3rd edition, Cambridge University.
3. Bessey. 1950. Morphology and Taxonomy of Fungi. The Blakistan, Co.,
4. Gilman, J. C. 1957. A Manual of Soil fungi.Lowa State College Press, ames, Lowa.
5. Kendrik, B. 2000. The Fifth Kingdom. #rd editiob. Focus Publishing, Newburyport,
6. Dube, H. C. 2013. An Introduction to Fungi. Scientific Publishers.

MICROBIAL TECHNOLOGY

SEMESTER I **Theory: 4 Hrs**
Core Elective paper-II **Credits: 3**

Unit-I

Brief history of fermentation; Fermentation- general concepts, Applications of fermentation; Range of fermentation process- Microbial biomass, enzymes, metabolites, recombinant products, transformation process; Component parts of a fermentation process.

Unit-II

Types of fermentations- Aerobic and anaerobic fermentation, Submerged and solid state fermentation; Factors affecting submerged and solid state fermentation; Substrates used in SSF and its advantages; Culture media- types, components and formulations. Sterilization: Batch and continuous sterilization.

Unit-III

Process development, Optimization of a process, Classical and statistical methods of optimization, Immobilization: different matrices, whole cell and enzyme immobilization; Scale up of bioprocess General concept of a fermenter- Batch, fed-batch and continuous fermentation.

Unit IV

Antisense and RNAi technology; Protein and DNA sequencing techniques- Maxam– Gilbert sequencing, Chain-termination methods, Massively Parallel Signature Sequencing (MPSS), Pyrosequencing, Illumina (Solexa) sequencing, Solid sequencing; Genomic and cDNA library preparation; RFLP; RAPD and AFLP techniques.

Unit V

Tracer techniques in biology: Concept of radioactivity; radioactivity counting methods with principles of different types of counters; scintillation counters; X-ray spectrometers; autoradiography; applications of radioactive tracers in biology, FACS.

SUGGESTED REFERENCES

1. Stanbury, P. F., Whitaker and Hall, A. S. J., Principles of Fermentation Technology. Butterworth-Heinemann

2. Shuler, M.L. and Karg, I F., Bioprocess Engineering Basic Concepts , Prentice Hall.

3. Vogel, H.C. Todaro, C.L. and Todaro C.C., Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, Noyes Data Corporation/ Noyes Publications.

4. Crueger W. and Crueger, A., Biotechnology. A Textbook of Industrial Microbiology, Sinauer Associates.

5. Reed, G., Prescott and Dunn's Industrial Microbiology, AVI publication

6. Casida L. E. J. R., Industrial Microbiology, New Age (1968)

7. Friefelder. D. (1982) Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2 nd ed. W.H. Freemen and Company, San Fransisco.

8.. Griffiths, O. M. (1983). Techniques of Preparative, Zonal and Continuous Flow Ultracentrifugation.

9. . William, B.L. and Wilson, K. (1986). A Biologist Guide to Principles and Techniques Practical Biochemistry, 3 rd ed., Edward Arnold Publisher, Baltimore, Maryland (USA).

10. Slater, R.J. (1990).Radioisotopes in Biology-A Practical Approach, Oxford University Press, New York.

MUSHROOM CULTIVATION AND MARKETING

SEMESTER II **Theory: 4 Hrs**
Core Elective paper - III **Credits: 3**

Unit I

History and introduction. Edible mushrooms and Poisonous mushrooms. Systematic position, morphology, distribution, structure and life cycle of *Agaricus* and *Pleurotus.*

Unit II

Nutritional value, medicinal value and advantages- types- milky, straw, button and poisonous mushrooms

Unit III

Cultivation: Paddy straw mushroom – substrate, spawn making. Methods – bed method, polythene bag method, field cultivation. Oyster mushroom cultivation –Substrate, spawning, pre-treatment of substrate. Maintenance of mushroom. Cultivation of white button mushroom – Spawn, composting, spawning, harvesting.

Unit IV

Diseases- Common pests, disease prevention and control measures. Processing - Blanching, steeping, sun drying, canning, pickling, freeze drying. Storage – short term and long term storage.

Unit V

Common Indian mushrooms. Production level, economic return, Foreign exchange from Mushroom cultivating countries and international trade.

SUGGESTED REFERENCES

1. Anonymous, **Indian Journal of Mushrooms.** Published by I.M.G.A. Mushroom Research Laboratory. College Agriculture, Solan

2. Gupta P.K. Elements of Biotechnology.

3. Harander Singh. 1991. Mushrooms- The Art of Cultivation- Sterling Publishers.

4. Kaul T N 2001. Biology and conservation of mushrooms. Oxford and IBH publishing company N.Delhi

5. Pandey B P 1996. A textbook of fungi. Chand and company N Delhi.

BIOSTATISTICS

SEMESTER III **Theory: 4 Hrs**
Core Elective paper-IV **Credits: 3**

Unit I:

Introduction to Biostatistics, sample collection and representation of Data – Primary and secondary classification and tabulation of Data – Diagrams, Graphs and presentation.

Unit II:

Analysis of quantitative characters and measures of central tendency of mean, Median, Mode, standard deviation and standard error, ANOVA.

Unit III:

Probability, basic principles – types – Rules oased on small sample statistics - comparisiion of probability – addition and Multiplication rules. Patterns of probability distribution, binomial – poisson and normal – Tests of significance; Chi – square test for goddness of fit; Null hypothesis, level of significance – Degree of freedom.

Unit IV:

Students – distribution, "t" test – estimation of population parameters based on small sample statistics – Comparision of sample mean with population mean – comparision means of two small sample of equal and unequal sizes – correlation – types of correlation – methods of study of correlation – testing the significance of the coefficients of correlation – regression and types.

Unit V:

Computer application in Biology – Computer memory and storage devices – operating systems and application programmes – MS, DOS, MAS, MS Ecxcel and statistical functions – ANOVA . Basic introduction to Multivariable analysis of variance (MANOVA).

SUGGESTED REFERENCES

1. Guruman, N. 2005. Biostatistics, 2nd edn, MJP Publications, India.
2. Milton, J. S. 1992. Statistical Method in Biological and Health Sciences. McGraw Hill Inc., New York.
3. Schefler, W. C. 1968. Statistics for Biological Sciences , Addision- Wesley Publication Co., London.
4. Snedecor, G. W. and Cocham, W. G. 1967. Statistical methods. Orford & IBH Publication Co., New Delhi
5. Spiegel, M. R. 1981. Theory and problems of Statistics, Schaum's Outline series Mc-Graw – Hill International BookCo., Singapore.
6. Pillai, R. S. N. and Bagawathi, V. 1989. Statistics. Theory and Practice (For B. Com and B. A. (Eco) classes) S. Chand & Co. Ltd., New Delhi.
7. Stansfield, W. D. 1986. Theory and problems of genetics (including 600 problems). Schaum's outline series. McGraw Hill Book Co., NewYork.
8. Sobl, R. R. and Rohif, F. J. 1969. Biometr4y. The principles and practice and Statistics in Biological Research. W. H. Freman and Co., san Francisco.
9. Pillai, R.S. N and Bagawathi, V. 1987. Practical Statistics (For B.Com and B. A. students) S. Chand & Co., (Pvt.) Ltd., New York.
10. Mahajan, B. K. 1984. Methods in Biostatistics for Medical students and Research works. Smt. Indu Mahajan, New Delhi.

ETHNOBOTANY

SEMESTER IV **Theory: 4 Hrs**
Core Elective Paper-V **Credits: 3**

Unit - I

Ethnoboatany – concepts and definitions. Subdisciplines of ethnobotany, Interdisciplinary approaches. Knowledge of following sociological and anthropological terms; culture, values and norms, institutions, culture diffusionand ethnocentrism. Historyof Ethnobotany; a brief history of ethnobotanical studies in the world and in India.

Unit – II

Distribution of tribes in India. Basic knowledge of following tribes of Tamil Nadu ; Irulas, Kanis, Paliyars and Malayalis.

Unit – III

Sources of ethnobotanical data; Primary – archeological sources and inventories. Secondary – Travelogues, folklore and literary source, herbaria, medicinal texts and official records. Methods in ethnobotanical research. Prior Informed Consent, PRA techniques,, interviews and questionnaire methods, choice of resources persons.

Unit - IV

Ethnobotanical knowledge and communities; Folk Taxonomy Plants associated with culture and socio-religious activities. Non Timber Forest produce (NTFP) and livelihood Sustainable harvest and value addition.

Unit - V

Bioprospecting and commercial use of traditional knowledge. Developing research partnership: Codes of ethics and research guidelines, equitable research relationships, Traditional knowledge (TK) in relation to Intellectual Property Rightsand Biopiracy. Equitable Benefit sharing models of the world. Problems in equitable benefit sharing.

SUGGESTED REFERENCES

1. Apte. T. 2006. Intellectual Property Rights, Biodiversity and Traditional Knowledge. Kalpavrisk, Grain and IIED, Pune/New Delhi.
2. Cotton, C. M. 1997. Ethnobotany – Principles and Applications. John Willey And SonsLimited, New York, USA.
3. Jain, S. K. 1989. Methods and Approaches in Ethnobotany. Society of Ethnobotanists. Lucknow.
4. Laird, S. A. 2002. Biodiversity and Traditional Knowledgwe Equitable partnership in Earthscan Publications Ltd., London.
5. Lewis, W. H. and M. P. F Elvin Lewis, 1976. Medical Botany. Plants affecting man's Health. A Wiley Interscience Publication , John Wiley and Sons. New York.
6. Martin, G. 1994. Ethnobiology . Chapman and Hall. London.
7. Singh, K. S. 1998. India's communities , Orford University Press, Delhi. Vols I – VI.
8. Rastogi, R. P., and B. N. Mehrotra. 1993. Compenmdium of Indian Medicinal Plants Vol I and Vol II . CSIR. Kucknow. Publicastion and Information Directorate, New Delhi.
9. Schultes, R. E. and S. V. Reis. (Eds.). 1995. Ethnobotany. Evolution of a disciplen. Chapman and Hall. London.
10. Simpson, B. B. and M. C. Ogorzaly. 1986. Economic Botany. Plants in our world. McGraw Hill Company. New York