KUVEMPU UNIVERSITY

M.Sc., BOTANY PROGRAMME

CHOICE BASED CREDIT SYSTEM
Course Curriculum and Scheme of Evaluation

DEPARTMENT OF APPLIED BOTANY
JNANASAHYADRI, SHANKARAGHATTA-577451
SHIMOGA DIST, KARNATAKA

KUVEMPU UNIVERSITY

M.Sc. BOTANY

PROGRAMME (CBCS)

Admission

The norms of admission as per the existing university regulations will be followed.

Duration of the Course: Four semesters (2 years)

Number of courses and credits required

I Semester with 3 hardcore papers, II, III and IV semesters with two Hard Core papers and one Soft Core paper (three theory and three practical), each with 4 credits offered respectively. II and III semester with one elective paper which is interdisciplinary in nature. In IV semester 2 Hard Core papers are offered with 8 credits and one dissertation with 5 credits, one viva voce examination. Three soft skill papers on communication and language skills with 3 credits each also offered.

Selection of subject for dissertation: A subject is to be selected by each student for dissertation based on the facilities available and the specializations of the supervising teachers.

Evaluation : Evaluation is to be carried out both by internal continuous evaluation and terminal evaluation. Out of the total weightage for each course, 25 marks are to be given for internal continuous evaluation and 75 for semester end examination.

1. Internal continuous evaluation

Internal evaluation will be carried out by the teacher/ teachers offering the course. The marks will be displayed on the notice board of the department and the students shall be given a chance to redress grievances if any. Internal assessment will be calculated based on their performance in attendance, assignments, tests, seminars, regularity, involvement and dissertation work.

2. External terminal evaluation

At the end of each semester, there will be external evaluation for each course. The pattern of theory question paper will be as per the general regulations of CBCS scheme. The pattern of practical question papers will be finalized by the concerned board of examiners. The answer scripts of each theory course will be valued by one member of the board of examiners constituted by the university for the purpose. The practical examination will be conducted by two members each of the board of examiners constituted by the university. Each dissertation will be valued by two examiners. The candidates will be presenting the salient features of their work and dissertation by way of power point presentation. One improvement chance will be given to the candidate in the case of each test. Theory examinations will be of 3 hours duration and practical examination of 3 hours duration with a break in between. The students will have to submit their practical records on the day of the practical examination.

Pass and overall grade : Pass and overall grade will be as per the general regulation of CBCS.

KUVEMPU UNIVERSITY

M.Sc. BOTANY

PROGRAMME (CBCS)

Department of Applied Botany, Jnana Sahyadri, Shankaraghatta-577451

CHOICE BASED CREDIT SYSTEM

M.Sc Botany -I semester

Course Structure and Scheme of Evaluation

Paper Code No	Titles of Theory Paper	Total Credits per week	Theory Examination marks	Internal Assessment marks	Total marks
BO1-401	HC-I :Bacteria, Algae Viruses, Fungi and Plant Pathology	04	75	25	100
BO1-402	HC-II Lichens ,Bryophytes, Pteridophytes and Gymnosperms	04	75	25	100
BO1-403	HC-III : Plant Taxonomy and Diversity of Angiosperms	04	75	25	100
BO1-404	SC-1: Mycology	04	75	25	100
	OR				
BO1-405	SC-2 Crop Plant Resources and Utilization	04	75	25	100
	OR				
BO1-406	SC-3 Traditional Systems of Plant Medicine	04	75	25	100
BO1-407	HC-I: Practical: HC-I : Bacteria, Algae Viruses, Fungi and Plant Pathology	02	-	-	50
BO1-408	HC-I: Practical: Lichens Bryophytes, Pteridophytes and Gymnosperms	02	-	-	50
BO1-409	HC-III: Practical: Plant Taxonomy and Diversity of Angiosperms	02	-	-	50
BO1-410	SC-1 :Practical: Mycology	02	-	-	50
BO1-411	SC-2: Practical: Crop Plant Resources and Utilization	02	-	-	50
BO1-412	SC-3 : Practical :Traditional Systems of Plant Medicine	02	-	-	50
	Total marks for Theory Total Practical marks (I Sem) Grand Total marks for I Semester				400 150 550

Note : HC-Hard Core paper, SC –Soft Core paper

KUVEMPU UNIVERSITY

M.Sc. BOTANY

Department of Applied Botany, Jnana Sahyadri, Shankaraghatta-577451

CHOICE BASED CREDIT SYSTEM

M.Sc., Botany -II semester

Course Structure and Scheme of Evaluation

Paper Code No	Titles of Theory Paper	Total Credits per week	Theory Examination marks	Internal Assessment marks	Total marks
BO2-451	HC-I: Ecology and Environmental Biology	04	75	25	100
BO2-452	HC-II: Embryology and Economic Botany	04	75	25	100
BO2-453	SC-1 :Plant Pathology	04	75	25	100
	OR				
BO2-454	SC-2 : Forest Resources and Utilization	04	75	25	100
	OR				
BO2-455	SC-3 Diversity & Conservation of Medicinal Plants	04	75	25	100
	OR				
BO2-456	HC-1 : Practical: Ecology and Environmental Biology	02	-	-	50
BO2-457	HC2 HC-II: Practical : Embryology and Economic Botany	02	-	-	50
BO2-458	SC-1 : Practical : Plant Pathology	02	-	-	50
BO2-459	SC-2: Practical: Forest Resources and Utilization	02	-	-	50
BO2-460	SC-3: Diversity & Conservation of Medicinal Plants	02	-	-	50
	Inter Disciplinary elective				
BO2-461	Floriculture	02	40	10	50
	Total marks for Theory				350
	Total Practical marks (II Sem)				150
	Grand Total marks for II Semester				500

KUVEMPU UNIVERSITY

Department of Applied Botany, Jnana Sahyadri, Shankaraghatta-577451
CHOICE BASED CREDIT SYSTEM
M.Sc Botany -III semester
Course Structure and Scheme of Evaluation

Paper Code No	Titles of Theory Paper	Total Credits per week	Theory Examination marks	Internal Assessment marks	Total marks
BO3-501	HC-1: Techniques in Plant Sciences and Anatomy	04	75	25	100
BO3-502	HC-2 :Plant Physiology and Metabolism	04	75	25	100
BO3-503	SC-1 :Molecular Plant Pathology				
BO3-504	SC-2:Biodiversity Conservation & Management	04	75	25	100
BO3-505	SC-3 Phytochemistry and Pharmacognosy of Medicinal Plants	04	75	25	100
BO3-506	HC-1 : Practical : Techniques in Plant Sciences and Anatomy	02	-	-	50
BO3-507	HC-2 :Practical: Plant Physiology and Metabolism	02	-	-	50
BO3-508	SC-1 : Practical: Molecular plant Pathology	02	-	-	50
BO3-509	SC-2: Practical: Biodiversity Conservation & Management	02	-	-	50
BO3-510	SC-3 : Practical: Phytochemistry and Pharmacognosy of Medicinal Plants)	02	-	-	50
	Inter Disciplinary elective				
BO3-511	Bio fertilizers and Biopesticides	02	40	10	50
	Total marks for Theory				350
	Total Practical marks (III Sem)				150
	Grand Total for III Semester				500

KUVEMPU UNIVERSITY

Department of Applied Botany, Jnana Sahyadri, Shankaraghatta-577451
CHOICE BASED CREDIT SYSTEM
M.Sc Botany -IV semester
Course Structure and Scheme of Evaluation

Paper Code No	Titles of Theory Paper	Total Credits per week	Theory Examination marks	Internal Assessment marks	Total marks
BO4-551	HC-1 : Genetics and Plant Breeding	04	75	25	100
BO4-552	HC-2: Molecular Biology and Biotechnology	04	75	25	100
BO4-553	HC-1 :Practical : Genetics and Plant Breeding	02	-	-	50
BO4-554	HC-2: Practical: Molecular Biology and Biotechnology	02	-	-	50
	Total marks for Theory Total marks for Practical's Grand Total marks for IV Semester				200 100 300
BO4-555	Project Work and Submission of Dissertation	75	25	100	

Project dissertation shall be evaluated by one external subject expert and one internal guide.

Grand Total of I Semester	550
Grand Total of II Semester	500
Grand Total of III Semester	500
Grand Total of IV Semester	400
TOTAL MARKS	**1950**

I SEMESTER SYLLABUS

Paper: Hard core 1 (Credits –4)

Paper Code: BO1-401 **64 hours**

BACTERIA, ALGAE, VIRUSES, FUNGI AND PLANT PATHOLOGY

THEORY

1. **Bacteria:** General characteristics, classification, bacterial growth, ultra structure, reproduction: fission and genetic recombination (transformation, transduction and conjugation); role of Bacteria in agriculture and nitrogen fixation, industry food and medicine. Bacterial diseases: Citrus canker, Black arm of Cotton and food spoilage, economical importance of bacteria. Bacterial plasmids and their characteristics. **08h.**

2. **Algae, general characters, thallus organization and reproduction :** Ultra structure of prokaryotic and eukaryotic algal cells, principles and modern trends in algal classification. Evolution and phylogeny of different groups of algae. Economic importance of algae, Algae causing biological disturbances, algal blooms, phytotoxins and their significance. **04 h.**

3. **Structure, reproduction, life cycle, relationship and evolutionary trends in the following groups with reference to the type mentioned under each group :** Cyanophyceae (*Gloeocapsa, Anabaena),* Chlorophyceae (*Chlamydomonas, Chlorella,),* Xanthophyceae (*Vaucheria* and *Botrydium),* Bacillariophyceae (*Navicula* and *Pilnnularia),* Dinophyceae (*Peridium),* Cryptophyceae (*Cryptomonas),* Phaeophyceae (*Ectocarpus* and *Sagassum),* Rhodophyceae (*Batrachopsermum,* and *Polysiphonia),* Euglenophyceae (*Euglena),* Charophyceae (*Nitella*). **08 h.**

4. **Viruses:** General characteristics, classification, ultra structure (TMV & Bacteriophage); infection and multiplication of Phage, purification methods, transmission and reproduction. Viral diseases: TMV, YBMV and Papaya Ring Spot Virus (PRSV), Viroids and Prions.

   Phytoplasma: Ultra structure and classification; symptoms caused; Sandal spike, little leaf of *Vinca rosea*, grassy shoot of sugar cane, citrus greening. **08h.**

5. **Fungi:** Introduction, morphology, ultra structure, contribution of any ten National and International mycologists, culture media, preservation techniques.
Allexopoulos system of classification up to order, life cycle of two fungi from each division, Role of fungi in agriculture and medicine. **16h.**

6. **Plant pathology:** History and development of Plant Pathology, Disease concept in plants: Disease classification, Causal factors - biotic and abiotic, disease diagnosis, Koch's postulates. **04h.**

7. **Defense Mechanism in plants:** Structural and Biochemical. Genetics of host – pathogen interaction: Gene to gene and polygene hypotheses. Immune and hypersensitive reactions. **04h.**

8. **Epidemiology:** Traditional and modern concepts of disease triangle, Role of host, pathogen and environment in disease development. Aerobiology in relation to epidemiology. Monitoring splash borne and airborne inoculum. **04h.**

9. Methods of assessment of disease incidence and disease severity and estimation of yield loss. Study of plant diseases of major crops caused by fungi, bacteria and viruses. (With reference to symptoms, etiology and control). **08h.**

10. **Principles of plant disease control:** Regulatory Methods: Plant quarantine regulation, inspection and certification. Physical Methods: Heat and cold treatment (Hot water, Hot air, Radiation treatment). Cultural Methods: Crop rotation, Flooding, Solarization, trap crops. Chemical Methods: Prophylactants and systemic chemicals. Methods of fungicide application. Seed and soil treatment. Control of post harvest diseases. Biological Methods: Use of antagonistic microorganisms. VAM fungi and control of soil borne diseases. Cross protection. **12h.**

I SEMESTER SYLLABUS
Paper: Hard core 1 (Credits –2)

Paper Code: BO1-408 **64 hours**

BACTERIA, ALGAE, VIRUSES, FUNGI AND PLANT PATHOLOGY

PRACTICALS

1. Sterilization techniques.
2. Media preparation and pure culture techniques.
3. Viral diseases, TMV, leaf curl of vegetables, papaya ring spot.
4. phytoplasmal diseases, sandal spike, little leaf of *Vinca rosea*, grassy shoot of sugar cane
5. Isolation of bacteria and fungi from infected plant parts.
6. Bacterial leaf blight of paddy and citrus canker, tomato canker.
7. Macro fungal fruit bodies – *Agaricus, Dictyophora, Ganoderma, Geastrum, Lycoperdon, Peziza* and *xylaria.*
8. Range of vegetative organization. Reproductive bodies. Range of vegetative organization. Different types of asexual and sexual reproductive and reproductive bodies. Phytoplankton and benthos of freshwater and marine ecosystems. Cyanophyceae (*Gloeocapsa, Anabaena),* Chlorophyceae (*Chlamydomonas, Chlorella,),* Xanthophyceae (*Vaucheria* and *Botrydium),* Bacillariophyceae (*Navicula* and *Pilnnularia),* Dinophyceae (*Peridium),* Cryptophyceae (*Cryptomonas),* Phaeophyceae (*Ectocarpus* and *Sagassum),* Rhodophyceae (*Batrachopsermum,* and *Polysiphonia),* Euglenophyceae (*Euglena),* Charophyceae (*Nitella*)
9. Fruiting bodies of fungi – *Acervuli, Pycnidia, Sclerotia*.
10. Tikka disease of groundnut and Root knot of brinjal.
11. *Alternaria* leaf spot of tomato/chilli/brinjal.
12. Commonly available fungicides on seed borne diseases.
13. Effect of biocontrol agent on seed borne diseases.

References

1. Agrios, G. N. 1997. **Plant Pathology.** Fourth Edition. Academic Press, U S A.
2. Alexepoulos, C.J. and C.W. Mims. 1989. **Introductory Mycology**. Wiley Eastern Ltd., New Delhi.
3. Aneja, K.R. 1993. **Experiments in Microbiology - Plant Pathology and Tissueculture.** Viswa Prakashan, New Delhi.
4. Burdon. **Diseases and Plant Population Biology.** Cambridge University Press, Cambridge.
5. Fox, R.T.V. 1993. **Principle of Diagnostic Techniques in Plant Pathology.** CAB International, Wallingford, UK.
6. Gregery, P.H. 1961. **Microbiology of Atmosphere**. 2nd Ed. Leonard Hill Books, Aylesbury, Bucks.
7. Ieffreies, P. and T.W. Young. 1994. **Inter-Fungal Parasitic Relationship.** CAB International, Wallingford. UK.
8. Ilan Chet. 1987. **Innovative Approaches to Plant Disease Control.** Wiley Inter Science Publications, John Wiley and Sons, New York.
9. Ingold, C.T. 1971. **Fungal Spores - Their Liberation and Dispersal.** Oxford University Press, London.
10. Nagarajan, S. 1983. **Plant Disease Epidemiology.** Oxford and IBH Publishing Co., New Delhi.
11. Pathak, V.N. 1984. **Laboratory Manual of Plant Pathology.** 2nd Ed. Oxford and IBH Publishers, New Delhi.
12. Rangaswamy, G. 1979. **Diseases of Crop Plants in India.** Prentice Hall, New Delhi.
13. Singh, R.S. **Introduction to Principles of Plant Pathology.** Oxford and IBH, New Delhi.
14. Tarr, S.A. **Principles of Plant Pathology.** McMillan Publishers Ltd., London.
15. Wolfe, M.S. and C.E. Caten. 1987. **Population of Plant Pathogen**. Blackwell Scientific Publications. Oxford.

I SEMESTER SYLLABUS

PAPER: HARD CORE 2 (CREDITS –4)

Paper Code: BO1-401 **64 Hours**

LICHENS, BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS

THEORY

Objectives : To understand the lower plant diversity and range of their thallus organization and reproduction and also to understand their role in ecosystem, genetic and cultural diversity, uses and their conservation.

Unit-1 : Lichens: General account of Lichens: Structure and types (forms) of lichens. thallus structure and relationship between components, Photobionts and mycobionts. Reproduction in lichens, ascolichens, basidiolichens, Lichenicolous fungi, Ecological and Economic importance of Lichens. **08h.**

Unit-2 : Bryophytes, characters and classification, structural organization of gametophytes and sporophytes, thallus organization and reproductive features, morphology, anatomy, life cycle of Sphaerocarpus (Sphaerocarales), Marchantia (Marchantiales), Porella (Jungarmaniales), Anthoceros (Anthocerotales), Sphagnum (Sphagnales), Andrea (Andreales), Funaria (Funariales) and Polytrichum (Polytrichales). **08h.**

Unit-3 : Evolution and affinities of the bryophytes, fossil bryophytes, origin of bryophytes, upgrade or progressive and down-grade or regressive theories of evolution, affinities of bryophytes, ecology and cytological aspects of bryophytes, amphibians adaptations and bryophytes as the indicators of water and air pollution. **12h.**

Unit-4 : Pteridophytes, characteristics and classification, morphology, anatomy and reproduction in *Psilotum, Selaginella, Equisetum, Lycopodium, Pteridium* and *Salvinia*. **08h.**

Unit-5 : Origin of Pteridophytes, evolution of the pteridophytic taxa, fossil pteridophytes, evolution of the stele, heterospory and seed habitat, economic importance of pteridophytes, rare, endangered and endemic pteridophytes with reference to India. Conservation with reference to *in situ* and *ex situ* conservation, horticultural importance of pteridophytes, weed problems, aquatic and terrestrial weeds of pteridophytes, medicinal and edible pteridophytes, *Azolla* as a biofertilizers and pteridophytes are ecological indicators. **12 h**

Unit-6 : Gymnosperms, characteristics and classification, morphology, anatomy and reproduction in *Cycus, Pinus, Aracaria, Ginkgo, Ephedra* and *Gnetum*. **08 h**

Unit-7: General account on Pteridopsermopsida, Cycadofilicales, Glosso-pteridales and Caytoniales, economic importance of gymnosperms, affinities of gymnosperms with reference to Gnetum. **08 h**

PRACTICALS

BO1 – 407 – HC-1

LICHENS, BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS

Lichens

1. Vegetative and anatomical features of different types of lichens.
2. Reproductive bodies. Identification of *Parmalia*, *Usnea*, *Ramalina*, *Dirinaria* and *Parmotrema*.

Bryophytes

3. Vegetative organization and morphology.
4. Anatomical structures.
5. Archegonia, antheridia and their organization.
6. Sporophytes – A Comparative Study.

Pteridophytes

7. Structure of plant body (habit).
8. Anatomical organization of different parts of the plants.
9. Sporangia and their types.
10. Spores, structure, size and ornamentation.
11. Fossil pteridophytes.

Gymnosperms

12. Morphology and Anatomical Features.
13. Male and Female Reproductive Bodies / Organs.
14. Seeds of Gymnosperms.
15. Fossil Gymnosperms.

References

1. Ajay Singh. 1961. **Lichens of India.**
2. Campbell, H.D. **The Evolution of Land Plants. (Embryophyta)**.
3. Chamberlain, C.J. 1935. **Gymnosperms – Structure and Evolution.**
4. Champman, V.J. **Sea Weeds and their Uses.** Methew and Co., London.
5. Chopra, R.N. and Kumar, P.K. **Biology of Bryophytes**. Wiley Eastern Limited.
6. Dallimore, W. and Jackson, A.B. 1961. **A Handbook of Coniferales and Ginkgoales**.
7. Fogg, G.E. Stewart, W.D.P. Fay and Walshy, A.E. **The Blue Green Algae.** Academic Press.
8. Foster, A.S. and Gifford, E.M. 1959. **Comparative Morphology of Vascular Plants.**
9. Gangulee, H.R. and Ashok Kumar. 1989. **College Botany.** Vol. II. Revised edition, Reprint 1994. New Central Book Agency (P.) Ltd., 8/1 Chinkmoni Das Lane, Calcutta – 700 009.
10. Garbary, David, J. and South G. Robin. 1990. **Evolution, Biogeography of the Marine Algae of the North Atlantic.** Published by London Springer Verlag.
11. Geider, Richard J. Osborne and Bruce, A. 1991. **Algal Photosynthesis.** Chapman and Hall Ltd., London.
12. Greguss, F. 1955. **Identification of Living Gymnosperms on the Basis of Xyletmy.**
13. Kashyap, A.K. and Kumar, H.D. **Recent Advances in Phycology.** Rastogi and Company.
14. Maheshwari, P. and Konat, R.N. 1971. **Pinus, Monograph.**
15. Maheshwari, P. and Vasil. **Gnetum, Monograph.**
16. Misra and Aparayel, R.P. 1978. **Lichens**.
17. Pandey, S.M. Trivedi, P.S. 1995. **Textbook of Algae.** Vikas Publishing House, New Delhi.

18. Pandey, S.N., Misra, S.P. and Trivedi, P.S. 1977. **Textbook of Botany, Bryophyta, Pteridophyta, Gymnosperms and Paleobotany.** 2nd Edition. Vikas Publishing House, New Delhi.

19. Rashid, A. 1998. **Introduction to Bryophyta**. Vikas Publishing House Pvt., Ltd., New Delhi.

20. Sambamurthy, A.V.S.S. 2005. **A Textbook of Bryophyta, Pteridophyta, Gymnosperms and Paleobotany.** IK International Pvt., Ltd., New Delhi.

21. Smith, G.M. **Cryptogamic Botany.** Vol. I, McGraw Hill Book Company, New Delhi.

22. Smith, G.M. **Cryptogamic Botany.** Vol. II, McGraw Hill Book Company, New Delhi.

23. Sundarlingam, V.S. 1989. **Marine Algae ; Morphology, Reproduction and Biology.** Bishan Singh, Mahendrapal Singh Dehradun.

24. Surenge, K.R. 1996. **Indian Fossil Pteridophytes.** CSIR Monograph, New Delhi.

25. Trivedi and Pravin Chandra. 2001. **Algal Biotechnology.** Jaipur Pointer Publishers.

26. Vashishta, B.R. 1990. **Botany for a Degree Students – Bryophytes**. 7th edition, S. Chand and Company Ltd., Ramnagar, New Delhi – 110 055.

I SEMESTER SYLLABUS

Paper: Hard core 3 (Credits –4)

PLANT TAXONOMY AND DIVERSITY OF ANGIOSPERMS

Paper Code: BO1-403 **64 hours**

THEORY

Objectives

This paper aims to study the basic values of plant taxonomy; to know about the basic concepts and principles of plant classification; to make a suitable method for correct identification and to be aware of the ecological and economic importance of plants.

Unit-1 : Historical background of plant classification : Major systems of classification; Sexual systems-Carolus Linnaeus. Natural system- deJussieu, de Candolle and Bentham and Hookers classification. Phylogenetic systems- Engler and Prantle, Hutchinson, Armen Takhtajan and Cronquist systems of classification. Angiosperm Phylogeny Group. **08h**

Unit-2 : Botanical Nomenclature: ICN[ICBN] Principles, Names of taxa, type method, author citation, effective and valid publication, rejection of names, names of hybrids and cultivated plants. IAPT. 08h

Unit-3 : Methods of herbarium preparation. Importance of herbarium. Botanical survey of India. Major botanical gardens of the world and their importance. **04h**

Unit-4 : Taxonomic structure: major and minor categories of classification. Evidence from various fields of Botany: Palynology, Embryology, phytochemistry, cyto-taxonomy and numerical taxonomy. **04h**

Unit-5 : Variation and speciation: Developmental variation, environmental variation, isolation mechanism, gradual speciation, concept of species. **08h**

Unit-6 : Study of the plant families with their phylogeny as per modern classification : Magnoliaceae, Nymphaeceae, Annonaceae, Dilleniaceae, Convolvulaceae, Solanaceae, Bignoniaceae, Rhamnaceae, Malvaceae, Meliaceae, Lythraceae, Combretaceae, Rubiaceae, Apocyanaceae, Ebenaceae, Sapotaceae, Verbenaceae, Asteraceae, Alismataceae, Hydrocharitaceae, Liliaceae, Zingiberaceae, Orchidaceae, Aracaceae, Poaceae. **08h**

Unit-8 : Principles and importance of plant geography- Phytogeographic regions of the world with a detailed study of Indian vegetation- Patterns of distribution. Theories of present day distribution of plants- Continental drift hypothesis-factors involved in distribution-Endemism, Age and Area hypothesis; Dispersal and Migration of plants. **08h**

Unit-9 : Status of angiosperm diversity, genetic diversity, species diversity, ecosystem diversity. Hot spots of biodiversity. Threats to Biodiversity, Management of species- *ex-situ* and *in- situ* conservation, Sustainable utilization of plant resources. **08h**

Unit-10: International organizations for biodiversity conservation: IUCN, species survival commission (SSC), Convention on Biological Diversity (CBD), CITES, TRAFFIC, WWF. Plant genetic resources- conservation, gene bank, NBPGR, IPGRI. **08h**

References

1 Agarwal. S.K.S. Tiwari and P.S. Dubey. 1966. **Biodiversity and Environment**. APH. Pub. Corp., New Delhi.

2 Bentham, G. and J.D. Hooker. 1862-83. **Genera *Plantarum*.** Vol.3. London.

3 Bhattachargya, B. and B.M. Johri. 1998. **Flowering Plants-Taxonomy and Phylogeny.** Narosa Pub. House, New Delhi. p. 753.

4 Cronquist, A. 1988. **The Education and Classification of Flowering Plants.** 2nd ed., Botanical Gardens, Bronx, New York.

5 Cronquist. A. 1968. **The Evolution and Classification of Flowering Plants.** Thomas Nelson, Edinburgh, London, pp. 1-396.

6 Hooker, J.D. 1894. **The Flora of British India.**, Reeve and Co. London. Vol. 6:1-792

7 Hutchinson J. 1926. **The Families of Flowering Plant.** Vol.1 Dicotyledons, McMillan, London, pp. 1-328.

8 Hutchinson. J. 1964-67. **The Genera of Flowering Plants.** Clarandon, Oxford, Vol 2.

9 Kormondy, E.J. 1986. **Concepts of Ecology.** 3rd ed. Prentice Hall of India, New Delhi, pp. 1-10.

10 Lawrence. G.H.M. 1967. **Taxonomy of Vascular Plants.** Oxford and IBH, New Delhi.

11 Myers, N.R.A. Mittermeier, C.G. Mittter Meri and G.A.B. Kents. 2000. **Biodiversity Hotspots for Conservation Priorities,** *Nature*, 403: 553-858.

12 Myers. N. 1988. **Threatened Biotas: Hotspots in Tropical Forestry.** *The Environmentalist*, 8:1-20.

13 Pulliah, T. 1998. **Taxonomy of Angiosperms**. Regency Publications, New Delhi.

14 Shukla, P. and S.P. Misra. 1985. **An Introduction to Taxonomy of Angiosperms.** Vani Educational Books, New Delhi (Internet).

15 Singh G., Misri, B. and P. Kachroo. 1972. **Achieve Morphology: An Aid to the Taxonomy of India Plants *Compositae, Liguliflorae.*** *J. Ind. Bot. Soc.* 51(3-4): 235-242.

16 Singh, G. 1999. **Plant Systematics : Theory and Practice.** Oxford and IBH Co. Pvt. Ltd., New Delhi, Calcutta, pp. 359.

17 Pramod Tandon. 2009. **Biodiversity and its Significance.** I.K. International Publishing House Ltd. New Delhi.

HARD CORE- 3- PRACTICALS :

BO1-409: PLANT TAXONOMY AND DIVERSITY OF ANGIOSPERMS

1. Introduction to literature in Plant taxonomy: Floras, Manuals, Monographs, Journals, Review articles.
2. Study of vegetative plant morphology-I: Typical Roots, Stems, and Leaves.
3. Study of vegetative plant morphology- II: Modified Roots, Stems, and Leaves.
4. Study of floral plant morphology-I: Inflorescence types
5. Study of floral plant morphology-II: Fruit types
6. Construction of floral diagrams and floral formulas two plants each from dicot and monocot plants.
7. Collection of plants and learning herbarium techniques.
8. Classification and identification of angiosperm plants which are available locally from the families of theory syllabus.
9. Identification of plants in field through field experience.
10. Construction of dichotomous keys for identification of plants.
11. Identification of plants through online resources from computerized keys.
12. Critical comment on a research paper for reporting new species by taking a published research article.
13. Identification and comment on economically important plant products.

FIRST SEMESTER
CHOICE BASED CREDIT SYSTEM
SOFT CORE -1(CREDITS – 4)

BO1-404: **MYCOLOGY** **64 hours**

Unit-1 : Introduction to Mycology - General characters of true fungi and fungi-like organisms; Hyphal ultrastructure; fungal wall and septa; main growth forms of fungi; mode of nutrition in fungi. General characteristics of fungal spores; asexual and sexual reproduction in different groups of fungi. Fungal cytology and genetics: Heterokaryosis, Parasexual cycle; Sex Pheromones (hormones) in fungi; Mechanism of nuclear inheritance; Mechanism of extra-nuclear inheritance. **08h**

Unit-2 : Classification of fungi(Alexopoulos and Mims, 1996 and modern system Systematic position, lifecycle and brief account of the following types:

Microsporidia-General account, Chytridiomycota ,Synchytrium, Blastocladiomycota-Allomyces, Pilobolus ,Neocallimastigomycota - General account Glomeromycota–Glomus, Ascomycota –Taphrina, Emericella, Neurospora, Gibberella, Glomerella, Morchella, Basidiomycota -Melampsora, Phallus, Ustilago,Oomycota. Fungi-like organisms –Stemonitis. **04h**

Unit-3 : Mutualistic symbiosis – Introduction and importance. Lichens – the mycobiont & phycobiont partners, morphological forms of lichens, crustose, foliose, fruticose, reproduction,nitrogen metabolism, growth rates of lichens. Mycorrhizae – introduction, kinds of mycorrhizae, biology of mycorrhizae, inoculation of mycorrhizae, ecto-mycorrhizae and endo-mycorrhizae, AM, Ericarean mycorrhizae, Endosymbiosis – detection of endophytes of plants and their taxonomy, endophytic mutualism, endophytic infections, effects on insects and herbivores, reaction of endophyte-associated plants to microbial pathogens and endophytic strategies. **08h**

Unit-4 : Genetic mechanisms in fungal adaptations: Pre and post zygotic barriers - vegetative incompatibility, sexual incompatibility- heterothallism, homothallism, meiotic mutants and spore killers, inter-sterility, examples of adaptive strategies (*Armellaria* and *Sclerotinia* species). **08h**

Unit-5 : Fungal community: fungal population in habitats and their characterization. Molecular techniques to analyze fungal population- isozyme analysis, and restriction fragment analysis, PCR amplification, properties of DNA sequences, mitochondrial, nuclear and ribosomal RNA genes. **12h**

Unit-6 : Fungal degradation of plant materials, decomposing fungi in soil and aquatic ecosystem, lignin and cellulose degrading fungi, importance of wood decay fungi in forest ecosystem, importance of lignicolous fungi in pulp industry. Fungal degradation of pesticides, plastic and heritage materials. **12h**

Unit-7 : Mushroom cultivation technology: Types of mushrooms (Edible and poisonous) and their economic importance. Cultivation of mushrooms (Button, oyster and paddy straw mushroom) – Selection of strains and maintenance, spawn production, cultivation methods, physiological requirements, crop managements for production. Medicinal and poisonous mushrooms – Bioactive compounds. **12h**

CHOICE BASED CREDIT SYSTEM – I SEMESTER

SOFT CORE I - PRACTICALS

BO1-410: PRACTICALS - MYCOLOGY

1. Isolation of VAM from root and soil samples.
2. Study on lichens and its partners.
3. Isolation of endophytic organisms from leguminous plants.
4. Isolation of rhizosphere and rhizoplane fungi.
5. Spore dispersal mechanisms.
6. Study on asexual and sexual fungal fruiting bodies.
7. Instruments- ELISA, PCR, PAGE, DNA sequencer.
8. Isolation of DNA from fungi.
9. Isolation of fungal protoplasts and fusion techniques.
10. Isolation of antagonistic fungi from soil.
11. *In vitro* fungal interaction studies.
12. Isolation of fungi by serial dilution techniques.
13. Isolation of cellulose and lignin degrading fungi from soil.
14. Isolation of fungi from pesticide contaminated soil.

References:

1. Alexopoulas, C.J. and Mims, C.W. 1979. **Introductory Mycology.** III Edition, Wiley Eastern, New Delhi.
2. Deacon, J.W. 1997. **Modern Mycology.** 3rd Edition, Blackwell Science Publishers, London.
3. Mueller, G.M., Bills, G.F. and Foster, M.S. 2004. **Biodiversity of Fungi.** Elsevier Academic Press, New York.

CHOICE BASED CREDIT SYSTEM - I SEMESTER

SOFT CORE II (CREDITS – 4)

CROP PLANT RESOURCES AND UTILIZATION

THEORY

BO1-405 **64 hours**

Unit-1 : Importance and nature of plant resources; plant resource and human welfare; present status of resources in India. Economic classification of plants. Plant wealth of India including lower plant resources (Algae, mosses, ferns, and lichen). **12h**

Unit-2 : Major cereals- Nature of cereals, wheat, maize, rice. Minor cereals and small grains- pearl millet, finger millet, fox tail millet. Pulses; black gram, green gram, horse gram, cowpea, chickpea, pea, pigeon pea, lentil. **12h**

Unit-3 : Production and utilization of oil seeds-groundnut coconut, palm oil, sunflower oil, Gingelly oil, safflower oil, soybean, linseed and caster. **12h**

Unit-4 : Tropical fruits – apple, Banana, Mango, papaya, jackfruit, grape, guava, cashew, orange, watermelon, vegetables in India. **08h**

Unit-5 : Spices and carminatives- Black pepper, cardamom, chili, coriander, cumin, fenugreek, garlic, ginger, turmeric, cloves, cinnamon, tamarind and curry leaf. **08h**

Unit-6 : Essential oils- Characteristics of essential oils, essential oil yielding plants, perfumes, perfume oils. Drugs and narcotics- Indian hemp, poppy, tobacco, and beedi leaf. Action and general chemistry of psychoactive drugs. **12h**

CHOICE BASED CREDIT SYSTEM - I SEMESTER

SOFT CORE II PRACTICALS

BO1-411: PRACTICALS - CROP PLANT RESOURCES AND UTILIZATION

1. Isolation, identification and culture of some blue green algae.
2. A study on sporophytes morphology and utilization of Sphagnum and a common fern.
3. Identification and utilization of major cereals, minor cereals, millets, pulses, oilseeds, tropical fruits, spices and carminatives, tannin and dye yielding products.
4. Micro chemical test of cereals to detect reducing and non-reducing sugar.
5. Estimation of fat/lipid content in oil seeds.
6. Protein analysis in legume seeds by Folin-phenol reagent.

References

1. Anonymous. 1948-1976. **The Wealth of India – A Dictionary of Indian Raw Materials and Industrial Products.** Vol. I to X. Publication and Information Directorate, CSIR, New Delhi.
2. Dastur, J.F. 1951. **Useful Plants of Pakistan.** B. Taraporewala Sons and Co. Ltd., Bombay.
3. Kochhar, S.L. 1981. **Economic Botany in the Tropics.** McMillan India Ltd., Madras.
4. Mukharjee, S.K. 1969. **Survey of Plants of India.** *Bull. Bot. Surv. India,* 11(3): 217-223.
5. Sambamurthy, A.V.S.S. and N.S. Subramaniyam. 1989. **A Textbook of Economic Botany.** Wily Eastern Ltd., New Delhi.
6. Albert E Hill and O P Sharma (1996). Economic Botany. Tata McGraw Hill Co. Ltd., New Delhi.

FIRST SMESTER
CHOICE BASED CREDIT SYSTEM
SOFT CORE (CREDITS – 4)

BO1-406: **64 hours**

TRADITIONAL SYSTEMS OF PLANT MEDICINE-SOFT CORE

Unit-1 : Introduction and scope of medicinal plants- Importance of medicinal plants over synthetic pharmaceutical medicine, renewed interest in herbal medicine by society and in the scientific community. **12h**

Unit-2 : Indian systems of medicine-Ayurveda, Siddha and Unani-dimensions, Chikitsas (branches), philosophical and theoretical bases. Principles and strategies of treatment. Ayurvedic pharmacopoeia and materia medica and current research trends. **08h**

Unit-3 : Popular systems of Medicine: Chinese, Tibetan and other systems (European and African) of medicine- History, philosophy, popular herbs and methods of treatment. **08h**

Unit-4 : Ethnobotany-definition, terminologies, scope, doctrine of signature, contribution of tribal and Indian ethno botanists, organizations and institutions involved in promoting tribal medicine. **12h**

Unit-5 : Plants in different therapies – Naturopathy, Aroma Therapy, Raw Juice Therapy, Herbal Cosmetics, Home remedies, Batch flower remedies and Nutraceuticals (therapeutic effects of plants used as food). **12h**

Unit-6 : Source of information on medicinal plants-Literature, National and international institutions and information on medicinal plants through web sites, CD ROM. **12h**

CHOICE BASED CREDIT SYSTEM - I SEMESTER

SOFT CORE III- PRACTICALS

CODE-BO1-406 : TRADITIONAL SYSTEMS OF PLANT MEDICINE

1. Aromatic plants – Eucalyptus, Mentha, Coleus, Ocimum, Patcholi, Cinnamon, Rose, Geranium, Jasmine.
2. Home remedies- Pungent spices; Pepper, Coriandar, Clove, Zinger, Citrus, Garlic, Tridax, Tribulus.
3. Plants of nutraceutical importance – Lemon, Lime, Custard apple, Cashew, Murraya, Carrot, Pumpkin, Beetroot, Lettuce, *Spirulina, Agaricus*
4. Flower remedies – Rose, Jasmine, Tuberose, *Pandanus*.
5. Survey of communities for ethno botanical knowledge.
6. Preparation of herbal formulations.

References

1. Acharya, Y.T. 1941. **Charakasamhitha.** Niranya Sagar Press, Bombay.
2. Aggarwal, V.S. and Ghosh, B. 1985. **Drug Plants of India (Root Drugs).** Kalyani Publishers, New Delhi.
3. Ambasta, S.P. 1988. **The Useful Plants of India.** CSIR, New Delhi.
4. Anonymous, 1922. **Five Hundred Indian Plants and their use in Medicine and in the Arts (In Karnataka).** 3rd edition, Kanarese Mission Press, Mangalore.
5. Anonymous. 1948. **The Wealth of India**. CSIR, New Delhi.
6. Kokatae, C.K., A.R. Purohit, S.B. Gokhale and D.K. Furia. 1990. **Pharmocognosy**. Nirali Prakashan, Pune.
7. Chopra, R.N., Nayar, S.L. and Chopra, I.C. 1956. **Glossary of Indian Medicinal Plants.** CSIR, New Delhi.
8. Cotton, C.M. 1996. **Ethnobotany, Principles and Applications.** John Wiley, New York.

II SEMESTER HARD CORE – 1 (CREDITS – 4)

HARD CORE- 1 : ECOLOGY AND ENVIORNMENTAL BIOLOGY

Paper Code: BO2-451 **64 Hours**

THEORY

Unit-1 : Scope of ecology in environmental management. Climatic factors: interaction of ecological factors- light-temp, precipitation, humidity, wind, and atmospheric gases; Fire factor; Edaphic factors-composition of soil- formation of soil, soil profile, soil classification, soil components and properties, soil erosion and conservation. **8h**

Unit-2 : Ecosystem – Structure and function; Energy flow, food chain, tropic levels. Ecological pyramids, charting of ecology; pathway and measurement rate; primary and secondary metabolic activities. **08h**

Unit-3 : Biogeochemical cycles : hydrological, gaseous (Carbon and Nitrogen) & sedimentary cycles, nutrient budget with reference to nitrogen, and carbon sequestration, climate change protocol, global warming issues. Ecological succession: models, trends and causes; time factor and stability. **08h**

Unit-4 : Population ecology: attributes, density and distribution, natality, mortality, age distribution, population growth, growth rate composition, Hardy Weinberg law. **08h**

Unit-5 : Major ecosystems of the world : pond , river, marine, deserts, tundra and forest, productivity of different ecosystems: grassland, forest, shola, savanna, thar, Chillka lake, Western and east Himalaya, Western Ghats. Ganga action plan. **04h**

Unit-6 : Water pollution: classification, chemical properties of water-effects of water pollution, indicators of water pollution, management and control measures., environmental pollution, pollution of water bodies, eutrophication, toxicity, microbes and pollution, indicators of pollution and control measures. **04h**

Unit-7 : Air pollution: classification and properties of air pollutants, effects of air pollution (health, vegetation and material damage), pollutant measurement, and management and control measures. Solid waste: introduction characteristics features, classification and disposal, Greenhouse effect, smog, CFC, ozone depletion, Elnino and Lanino effect, acid rain, thermal, noise, radioactive pollution and management. **08h**

Unit-8 : Hazardous waste management characteristics and types, sources of generation, composition, hazardous waste; soil pollution and indicators of soil pollution. Microbial degradation, and biotransformation, pesticide pollution and degradation. **08h**

Unit-9 : Remote sensing and GIS: Basic and fundamental concepts of remote sensing. **04h**

Unit-10 : Environmental Impact Assessment: Introduction, process and methods of impact analysis. International biological program, UNESCO, MAB. UNEP. **04h**

BO2-458 PRACTICALS:

ECOLOGY AND ENVIORNMENTAL BIOLOGY –HARD CORE -1

01. Analysis of water samples of lotic and lentic with reference to.

a.	Corbon dioxide	b.	Dissolved oxygen
c.	Total hardness	d.	Phosphate
e.	Sulphate	f.	Nitrates

02. Effect of So**2** and cl2 gasses on plants.

03. Microscopic examination of different soil types

04. Water holding capacity of different soil samples

05. Determination of organic content, carbonates, exchangeable bases and oxidzable organic content of soils

06. Study of vegetation by quadrat and transect method

07. Ecological instruments-Animometer, Lux meter, Rain guaze, Max and min thermometer

08. Visit to meteorological station

09. Drinking water purification

10. Ecological adaptations in hydrophytes, Xerophytes, Halophytes.

References

1. Ambasht, K.S. 1969. **Plant Ecology.** Published by Student's Friends and Co., Lanka Varansi, India.
2. Anji Reddy, M. 2006. **"A Textbook of Remote Sensing and Geographical information System".** 03rd Edition B.S. Publications.
3. Botkin, D.B. and E.A. Keller. 2004. **Environmental Science.** 5th ed. John Wiley and Sons.
4. Bernhardsen, T. 1999. **Geographic Information System : An Introduction.** 02nd Edition, John Wiley and Sons.
5. Canter, L.W. 1996. ***Environmental Impact Assessment.*** McGraw Hill, New York.
6. Charan and Anil, K. 1992. **Plant Geography.** Rawat Publications. Jaipur.
7. Chhatwal, G.R. and M.C. Mehra. 1989. **Environmental Air Pollution and its Control.** Anmol Publ., New Delhi.

8. Curran, P. 1985. **Principles of Remote Sensing.** Longman, Loudon.

9. Eug. Warming. 1998. **Ecology of Plants.** Ambey Publications, New Delhi.

10. Eugene P. Odum. 1996. **Ecology.** Sinauer Associates Inc Publishers, Sunderland, USA.

11. Goel, P.K. 1997. **Water Pollution Causes, Effects and Control.** New Age International Pvt., Ltd., new Delhi.

12. Kumar, A., Bohra, C. and L.K. Singh. 2003. **Environment, Pollution and Management.** A.P.H. Publishing Corporation, New Delhi.

13. Mido, Y. and S.A. Iqbal. 1995. **Chemistry of Air and Air Pollution.** Discovery Publishing House, New Delhi.

14. Mohan P. Arora. 1995. **Ecology.** Himalaya Publishing House, Bombay.

15. Ross, R.D. 1998. **Air Pollution and Industry.** Van Norstrand Company Publication.

16. Sapru, R.K. 1987. **Environment Management in India.** Patel Enterprises, New Delhi.

17. Shukla, S.K. and P.R. Srivastava. 1992. **Concepts in Environmental Impact Analysis.** Common Wealth Publishers, New Delhi.

18. Tripathy, D.P. 1999. **Noise Pollution.** A P H Publishing Corporation, New Delhi.

19. Verma. P.S. and Agarwal, V.K. 1992. **Principle of Ecology.** Published by S. Chand and Company Ltd., New Delhi.

20. Williams, I. 2001. **Environmental Chemistry.** John Wiley and Sons, Ltd., New York.

CHOICE BASED CREDIT SYSTEM- II SEMESTER

HARD CORE- 2 : EMBRYOLOGY AND ECONOMIC BOTANY

Code-BO3-452 **Credits-04**

64 h

Objectives

This paper aims to study the organization of plant body to understand its growth and development**.** To know the mechanism of shift from vegetative to reproductive phase, to understand the physiological role of male and female gametophytes , endosperm, development of embryo and to assess the process of seed setting and economic utilization of plants.

Unit-1 : Historical account of angiosperm embryology. Microsporangium: Anther wall development, sporogenous tissue, male gametophyte development, formation of vegetative and generative cells, pollen kit, scope of palynology. **04h**

Unit-2 : Megasporangium: types of ovules, integuments, nucellus, megasporogenesis: development of female gametophyte, types of embryo sac, components of mature embryo sac & their role, polyembryony, practical importance of polyembryony. **08h**

Unit-3 : Pollination and fertilization: Anther dehiscence, pollen transfer, germination and tube growth. Double fertilization, self incompatibility, physiology and biochemistry of self incompatibility, biological significance of self incompatibility. **08h**

Unit-4 : Endosperms and Embryo: Development of endosperms, types of endosperms, functions of endopserms. Embryo development in dicot and monocots. **08h**

Unit-5 : Apomixis and parthenocarpy : Their practical importance. Seed ,seed coat and fruit development, classification of seeds, special structures of seeds- caruncle, operculum, aril, seed dispersal. **04h**

Unit-6: Classification of Economic plants: Importance and nature of plant Products – Cereals and Millets: Description, cultivation, and uses of rice, wheat, maize, barley, oat; sorghum, bajra, rye, foxtail, proso millet, ragi, pseudo cereals – buckwheat, quinoa. Pulses and nuts: Description, cultivation, uses of pea/pigeon pea, cow pea, green gram and black gram, lentil, moth bean, field bean, lima bean, soy bean, broad bean, ground nut; cashew nut, walnut, pistachio, macadamia almond, chestnut, coconut. **08h**

Unit-7: Vegetables and fruits: Classification, description, cultivation, and uses of leafy vegetables – Spinach, amaranth, asparagus, lettuce; Cole crops – Cabbage, knol-khol, cauliflower; Root crops – carrot, turnip, radish; Bulb, tubers and corm – Onion, garlic, yams; tomato, French bean, lady's finger, guards/cucumber; Fruits – banana, mango, pomegranate, papaya, mandarins, guava, melons, pineapple, avocado, strawberry grapes and currants. **08h**

Unit-8: Spices and condiments: Description, cultivation, and uses ginger, turmeric, black pepper, cloves, cardamom, cinnamon, all spice. coriander, mustard,Medicinal and aromatic plants: Rauvolfia, Opium, Vinca, basil, Cinchona, Withania, mint, Cymbopogan, Vetiveria, safed musli, Santalum, eucalyptus. **04h**

Unit-9: Beverage plants: Coffee, tea, cocoa. Fermented beverage yielding plants – Wine, cereals, apple, sugarcane, beet and palm sugar. Fumitories, masticators and hallucinogens: Tobacco, areca nut, betel, opium, cannabinus. Oils: Essential oils-Extraction methods – Castor, mustard, groundnut, coconut, rapeseed, palm oil. **08h**

Unit-10: Timber: Classification, properties, description and uses of teak, rose wood, cedar, pine, sal, honne and lancewood. Minor forest products: Gums and resins, bamboos and canes, honey. **04h**

References

1. Bhojwani, S.S. and S.P. Bhatnagar. 1999. **The Embryology of Angiosperms.** Vikas Publishing House PVT Ltd. New Delhi.
2. Bhojwani, S.S. and Razdan, M.K. 1996. **Plant Tissue Culture: Theory and Practice.** A Revised Edition. Elsevier, Amsterdam.
3. Bouman F. 1978. **Ovule Initiation, Ovule Development and Seed Coat Structure in Angiosperms.** Today and Tomorrow Publishers, New Delhi.
4. Bhojwani S.S. and Bhatnagar, S.S. 1974. **The Embryology of Angiosperms.** Vikas Publication, New Delhi.
5. Davis, C.L. 1965. **Systematic Embryology of Angiosperms.** John Wiley.
6. Eames, A.J. 1960. **Morphology of Angiosperms.** McGraw Hill Publishers.
7. Johanson, D. 1950. **Plant Embryology.** Waltham, Massachusetts.
8. John, B.D. 1984. **Embryology of Angiosperms.** Springer Verlag.
9. Easu, E. **Plant Anatomy.** Wiley Eastern Pvt. Ltd., New Delhi.
10. Guptha, V.K. and Y.P. Varshneya. 1995-96. **Embryology of Angiosperms.** Kedarnath Ramnath, Meerut.
11. Johri, B.M. 1982. **Experimental Embryology of Vascular Plants.** Springer, Heidelberg.
12. Maheshwari, P. 1950. **An Introduction to Embryology of Angiosperms.** McGraw Hill, New York.
13. Pandey, B.P. 1981. **A Textbook of Botany-Angiosperms. Taxonomy, Anatomy, Embryology.** S. Chand and Company Ltd. New Delhi.
14. Shivanna, K.R. 2003. **Pollen Biology and Biotechnology.** Oxford and IBH Publishing Co. Pvt., Ltd., New Delhi.
15. Raghavan, V. 1976. **Experimental Embryogenesis in Plants.** Academic Press.

Hard Core- 2 Code-BO3-457-

EMBRYOLOGY AND ECONOMIC BOTANY

PRACTICALS

1 Study of stem cells in plants: shoot apical meristem and root meristem in *Ceratophyllum* and *Hydrilla* species.

2 Study to show polarity in stem cuttings in lower and higher plants.

3 Study to demonstrate regeneration in succulents (*Byrophyllum).*

4 Microsporangium: Slides: anther sac, wall layers; tapetum; two-celled & three-celled pollen; pollen tetrads.

5 Preparation of pollen grains to study external morphology by acetolysis method.

6 Pollen grain germination studies in *Balsam, Delonix, Hibiscus* and *Ipomea* plants.

7 Megasporangium: Slides –different types of embryo sacs , 4-nucleate 8- nucleate stages; mature embryo sac.

8 Micro dissection and endosperm mounting : *Cucumis sativus, Grevellia robusta.*

9 Embryo: Slides: Monocot and dicot plants.

10 Dissection and embryo mounting: *Crotalaria.*

11 Observation of seed appendages :operculum, caruncle, aril of nutmeg, perisperm.

CHOICE BASED CREDIT SYSTEM – II SEMESTER

SOFT CORE 1 (CREDITS – 4)

BO2-453: PLANT PATHOLOGY 64 HOURS

Unit-1 : Introduction, scope and significance of plant pathology, significant contributions of plant pathologists. Importance of plant diseases. Methods of studying plant diseases, classification of plant diseases. **04h**

Unit-2 : Major diseases caused by fungi, bacteria, viruses, mycoplasma, nematodes, angiosperm parasitic diseases, non-parasitic diseases on cereals, pulses, vegetables and oil crops. **08h**

Unit-3 : Pathogenesis: penetration - indirect entry of pathogens through natural openings, wounds, root hairs, buds, direct penetration. Role of toxins in pathogenesis- Introduction, microscopic system, bioassay, Host-relation toxins, non-host selective toxins, control of toxin biosynthesis **08h**

Unit-4 : Mode of transmission of pathogens by seeds air, soil, water, vectors, contagious, animals. Effect of environmental factors on disease development disease epidemiology and forecasting. **08h**

Unit-5 : Signaling in plant disease resistance mechanisms, genetic analysis, MAP kinases, ion-flexus and calcium homeostasis, the oxidative burst, nitric oxide, ppGpp signaling, low molecular weight signaling molecules, RNA as a signal, coordination of cell death responses and interplay of down stream signaling pathways. **08h**

Unit-6 : Detection and diagnosis of plant pathogenesis- Introduction host range and symptomatology, morphology of the causal organism, selective media, biochemical markers-substrate metabolism, fatty acid profiles (FAME analysis), protein analysis, serological techniques, nucleic acid techniques, choice of diagnostic techniques. **08h**

Unit-7 : Management of plant diseases by conventional methods: cultural, chemical and biological. **08h**

Unit-8 : Mycoparasitism of soil borne plant pathogens- biotropic and necrotropic parasitism, techniques for studying mycoparasitism in natural system, ecological factors affecting parasitism, distribution of mycoparasites, mycoparasites in biological control. Predatory and parasitic fungi - predatory hyphomycetes, and hymenomycetes. **12h**

CHOICE BASED CREDIT SYSTEM – II SEMESTER

SOFT CORE I - PRACTICALS

BO2-458: PRACTICAL - PLANT PATHOLOGY

1. Classification of plant disease

   Fungal: (Powdery mildew of cluster bean, leaf blight of paddy, leaf spot of chilli, frog eye spot leaf spot of tobacco)

   Bacterial: (Citrus canker)

   Viral: (Mosaic, leaf curl, pepper wilt, bunchy top of banana, katte disease of cardamom)

   Mycoplasma: (little leaf of brinjal, grassy shoot of sugar cane)

   Nematode: (root of brinjal/tomato)

   Angiospermic parasites: (loranthus, viscum, cuscuta)

2. Pure culture – identification of fungi based on conidia and mycelial morphology.
3. Spore release by wash-off method
4. Disease assessment
5. Anthracnose disease in French bean/ Cluster bean
6. Downy mildew of pearl millet
7. Leaf rust of coffee
8. Disease of crop plants - Fungal, mycoplasmal, bacterial, nematodal, viral, angiospermic parasitic diseases (other than above mentioned disease)

References

1. Singh, R.S. 1973. **Plant Disease.** Oxford and IBH Pub. Co., New Delhi.
2. Agrios, G.N. 1994. **Plant Pathology**. 2nd Edn. Academic Press New York.
3. Johnston, A. and Both, C. 1983. **Plant Pathologists Pocket Book.** 2nd Edn. Commonwealth Mycological Institute, Oxford and IBH Pub. Co., Calcutta.
4. Rangaswamy, G. and Mahadevan, A. 2002. **Diseases of Crop Plants in India.** Prentice Hall of India Pvt.Ltd., New Delhi.
5. Mehrotra, R.S. 1983. **Plant Pathology**. Tata McGraw Hill Pub. Co., Ltd., New Delhi.
6. Vidhyasekaran, P. 2004. **Encyclopedia of Plant Pathology.** Viva Books Pvt. Ltd., New Delhi.

CHOICE BASED CREDIT SYSTEM - II SEMESTER

SOFT CORE II (CREDITS – 4)

FOREST RESOURCES AND UTILIZATION

BO2-459: **64 hours**

Unit-1 : Types and distribution of forests of India and Karnataka- Concept of forest as a ecosystem; Sustainable development in the ecosystem context, natural resource rich areas and ecological issues. **12h**

Unit-2 : Forest management and conservation- Plantation forestry, Natural forest management, Joint forest management, and forestry as a component of landscape management, conservation and Biosphere concept **12h**

Unit-3 : Forest resources- (Wood and non wood products) Timber and wood- Fuel, poles and piling, plywood, constructed wood, particle board and fiber board, sawdust and shavings, wood flour. Gums and resins- Gums, resins, oleoresins. (*Acacia concinna*) *Sapindus emerginatus* etc.) **12h**

Unit-4 : Tannin and dye yielding plants: Tannins, The tanning industry, sources of tanning, materials, dyes and pigments. **08h**

Unit-5 : Sustainable tropical forestry- problems of deforestation, depletion of biological diversity, site degradation and desertification **08h**

Unit-6 : Management of forest products- plant resource economy in India. **08h**

CHOICE BASED CREDIT SYSTEM - II SEMESTER

SOFT CORE 2 - PRACTICALS

BO2-460: PRACTICALS - FOREST RESOURCES AND UTILIZATION

1. Mapping of forest resources in India.
2. Mapping of Forest resources in Karnataka.
3. Identification of some timber trees through wood characteristics.
4. Microchemical test to determine presence of latex in plant materials.
5. Microchemical test to determine presence of lignin in plant materials.
6. During the course of study each student should collect non-wood forest products and study their botany in laboratory.

References

1. Champion, H.G. and Seth, S.K. 1908. **Forest Types of India.** Manager Publications, Delhi.
2. Negi, S.S. 1990. **Forest Types of India.** Nepal and Bhutan, PEBA, Delhi.
3. Saldanha, C.J. 1984-1996. **Flora of Karnataka.** Vol. I and II. Oxford and IBH, New Delhi.
4. Gamble, J.S. 1957. **Flora of Presidency of Madras.** Vol. 1-3. Bishan Singh, Mahendra Pal Singh, Dehra Dun.
5. Krishnamurthy, T. 1993. **Minor Forest Products of India.** Oxford and IBH, New Delhi.
6. Shetty, B.V., Kaveriappa, K.M. and K.G. Bhat. 2000. **Plant Resources of Western Ghats and Low Lands of Dakshina Kannada, Udupi Districts.** Pilikula N.B.S., Mangalore.
7. Chopra, K. 1993. **The Value of Non-Timber Forest Products an Estimate from India.** *Economic Botany,* 36: 6-11, 251 – 257.
8. Sagraiya. 1994. **Forests and Forestry.** National Book Trust, India.

CHOICE BASED CREDIT SYSTEM -II SEMESTER

DIVERSITY AND CONSERVATION OF MEDICINAL PLANTS

SOFT CORE – 3(CREDITS – 4)

BO2-455: **64 Hours**

Unit-1 : Classification and nomenclature of medicinal plants - Classification based on origin (plant, animal, and minerals) and nature of plants (medicinal, poisonous plants and aromatic plants). Classification of crude plants based on–Alphabetical; Morphological; Pharmacological; Taxonomical; Chemical and Chemotaxonomic criteria. Vernacular and local names of medicinal plants. **12h**

Unit-2 : Commercial medicinal plants in therapeutics - *Catharanthus roseus, Aconitum ferax, Rauwolfia serpentina, Stychnos nux-vomica, Withania somnifera, Digitatis lanata, Atropa* sp*., Emblica officinalis, Mentha sp, Cymbopogan citratus, Aloe barbadensis, Vetivera zizinoides.* Reasons for commercialization, curative aids, chemical nature. Over exploitation and consequences. **12h**

Unit-3 : Narcotic plants – *Papaver somnifera, Atropa belladona, Cannabis sativa, Ephedra sinica.* Poisonous plants - *Aconitum ferox, Taxus wallichiana, Argemone mexicana, Nerium indicum, Arbus precatorius, Datura stramonium.* Weed plants - *Lantana camera, Stachytarpheta indica, Sida* spp., *Datura* spp,, *Cynodon* spp., *Solanum nigrum, Centella asiatica.* **08h**

Unit-4 : Aromatic plants as medicine - extraction and processing, export potential and medicinal uses, eg., *Santalum album, Cinnamomum camphora, Cymbopogon, Eucalyptus, Jasminum* spp., *Lavendula officinalis, Vetivera* sp*., Rosa damascena, Pogostemon perilloides (*Potcholi), *Rosamarinus officinalis.* **08h**

Unit-5 : Techniques of cultivation of medicinal plants-an eco-friendly approach - Nursery technique and cultivation practice, Biofertilization (manuring), disease and pest management: harvesting techniques and value addition of medicinal plants. E.g., *Atropa , Catheranthus, Rauwolfia, Aloe, Withania, Vettivera, Cymbopogan, Mentha* sp., C*hlorophytum boriveillianum (safed musli)* and *Acorus calamus***.** **08h**

Unit-6 : Cultivation of spices and their marketing; *Achorus calamus, Cinnamomum, Thymus vulgaris, Alpinia galanga, Mentha piperita, Papaver somnifera, Crocus sativus, Piper spp., Syzigium aromaticum, Cuminum cyminum.* **08h**

Unit-7 : Sustainable conservation and developmental strategies for medicinal plants-conservation of medicinal plant diversity in India, IUCN, SSC, CBD, CITES, Traffic, WWF for nature, red list of threatened species, red data book, conservation of biological and genetic diversity – In situ and ex situ conservation and sustainable utilization. Community based enterprises, research, and biodiversity bill. CIMAP, FRLHT. **08h**

BO2-460: SC 3: CHOICE BASED CREDIT SYSTEM -II SEMESTER

PRACTICALS: DIVERSITY AND CONSERVATION OF MEDICINAL PLANTS

SOFT CORE – 3(CREDITS – 4)

1. Study of medicinal plants
   a. *Clerodendron infortunatum* b. *Cassia mimosoids*
   c. *Solanum xanthocarpum* d. *Argyria cuneata*
   e. *Lantana cranulata* f. *Santalum album*
   g. *Lawsonia inermis* h. *Holorrhena antidysentrica*
   i. *Aloe berbadense* j. *Centella asiatica*
   k. *Morinda tinctoria* l. *Plumbago zeylanica*
   m. *Gymnema sylvestre* n. Other plants
2. Commercial medicinal plants
3. Vegetative propagation techniques
4. Diseases and pests of medicinal plants.
5. Visit to sanctuary, National parks, MPCA and Submission of reports.
6. Determination of density, abundances, and frequency of some medicinal plants by quadrat/ Transact/ point frame methods.

References

1. Acharya, Y.T. 1941. **Charakasamhitha.** commentary by Chakrapani. Niranya Sagar Press, Bombay.
2. Aggarwal, V.S. and Ghosh, B. 1985. Drug Plants of India. (Root Druga). Kalyani Publishers, New Delhi.
3. Ambasta, S.P. 1988. The Useful Plants of India. CSIR, New Delhi.
4. Anonymous. 1922. Five Hundred Indian Plants and Their Use in Medicine and in the Arts (In Karnataka). 3rd Edition, Kanarese Mission Press, Mangalore.
5. Anonymous. 1948. The Wealth of India. CSIR, New Delhi.
6. Kokatae, C.K., Purohit, A.R., Gokhale, S.B. and D.K. Furia. 1990. **Pharmocognosy**. Nirali Prakashan, Pune.
7. Chopra, R.N., Nayar, S.L. and Chopra, I.C. 1956. **Glossary of Indian Medicinal Plants.** CSIR, New Delhi.
8. Cotton, C.M. 1996. **Ethnobotany, Principles and Applications.** John Wiley, New York.

II SEMESTER - INTER DISCIPLINARY ELECTIVE
FLORICULTURE

B02-461 **FLORICULTURE (CREDITS – 1)** **16 Hours**

Unit-1 : Introduction to floriculture science – principles of floriculture, floriculture industry and its importance, (plant nomenclature, botany - plant structures, flowers, fragrance in flowers, genetics) cut flowers, wild flowers. **04h**

Unit-2 : a) World cut flower industry – overview of industry, international trade, exports, products, international and domestic consumption, characteristics of floriculture industry. b) Cut flower industry in India, commercial cut flowers of India and Karnataka, area, production, yield and value of certain commercial flowers in Karnataka, floriculture industries/companies in India, governmental support (NABARD, NHB, APEDA). **02h**

Unit-3 : Soil and fertilizers application – soil properties, fertilizer requirement. Plant propagation – propagating materials, propagation by asexual and sexual means, seed production. Nursery production – planting material, soil, and other media, containers, irrigation and fertilization, pest control and disease management. **04h**

Unit-4 : Pest and disease management – common pests of ornamental plants and flowers and their damage to plants/flowers and control, diseases caused by different agents damage and their control, weeds and their control and integrated pest management. **02h**.

Unit-5 : Floriculture in green house – to set up green house facilities, green house operation and management **02h**

Unit-6 : Post harvest handling of flowers– collection, delivery, transportation, protection from adverse climate (low temperature containers, humidity, packing, maintenance, air circulation and proper packaging), preservatives. **02h**

References

1. Prasad S and Kumar U 1998. **Commercial Floriculture.** AgroBotanica, Bikaner, India.
2. Alex Laurie and Victor, H.R. 2001. **Floriculture-Fundamental Practices.** Agrobios, Jodhpur, India.
3. Anon. 2004. **Horticultural Crop Statistics of Karnataka State at a Glance.** Directorate of Horticulture, Karnataka State Govt. Bangalore.
4. Anon. 2000. **Improved Horticultural Practices for High Yield (Kannada).** GKVK Campus, University of Agricultural Sciences. Bangalore.
5. Lyon, T.L. and Buckman, H.O. 1937. **The Nature and Properties of Soil.** The Macmillan Co. New York.
6. Van Slyke, L.L. 1932. **Fertilizers and Crop Production**. Orange Judd Publish. Co. Inc., New York.
7. Reddy, Y.T.N., Janakiram, T. and Satyanarayana Reddy, D. 2001. **Scientific Nursery Management (Fruit and Ornamental Plants).** The House of Sarpan (Media), Bangalore.
8. www.google.com ERS/USDA/floriculture crops or IMPAC: Asian references.
9. www. india agronet.com.
10. www. dial india.com.
11. www. tifac.org.in/offer.

III SEMESTER SYLLABUS

CHOICE BASED CREDIT SYSTEM

HARD CORE-1 : TECHNIQUES IN PLANT SCIENCES AND ANATOMY

Paper Code-BO3-501 (Credits – 4) 64 Hours

THEORY

1. Microscopy: Types - Bright field, phase contrast, fluorescence, confocal, inverted and electron.Micrometry: Haemocytometer, Stage and ocular micrometer, camera lucida.

Photo micrography: Killing, fixing and staining of plant tissue, free hand sections, permanent slides- embedding in paraffin, double stain, rotary microtome, clearing and maceration of techniques. **04h**

2. Spectroscopy: Principle of Beer- Lamberts Law, Colorimetry & Spectrophotometry, ultra violet and visible spectroscopy (UV-VIS), Fluorimetry, Atomic absorption spectroscopy. Mass Spectrometry (MS), Nuclear Magnetic Resonance (NMR),infra-Red Spectrometry(IR)and Flow cytometry.

Sedimentation: Centrifugation - Centripetal & Centrifugal force, Sedimentation coefficient and Sedimentation constant. **08h**

3. Chromatography: methods - Paper Chromatography, Thin Layer Chromatography (TLC), Column Chromatography, Affinity chromatography, Gas Chromatography, High Performance Liquid Chromatography, Autoradiography and Latest techniques. **Electrophoresis:** Principles, Proteins – native and SDS PAGE, Nucleic acids Agarose gel electrophoresis. **12h**

4. pH Meters: Conductivity meter, Electronic balance, steam and heat sterilization, Laminar air flow, Air spore measurements-Anderson sampler and Burkard spore trap. **04h**

5. Organogenesis in plants: Differentiation of plant body, totipotency, organization of shoot and root apical meristems, plant stem cells, formation of lateral roots and leaves. Anatomy of roots, stem, leaves of dicot and monocot plants. Tissue system in dicot and monocots. **12h**

6. Cell wall and its development : Chemistry of cell wall- cellulose, hemicellulose, polysaccharides, cell wall proteins, water. Organisation of primary wall. Cytokinesis and growth. Plasmodesmata. Secondary wall chemical Constituents- lignin, suberin, Organisation of secondary wall. **08h**

7. Vascular differentiation : Procambium, residual meristem, interfascicular and intrafascicular cambia; acropetal and basipetal differentiation in leaves, stem and roots. Sieve tube, differentiation. Control of phloem differentiation. Tracheary elements differentiation. Ultra structure of phloem and xylem, brief account of transfer cells. Secondary wall thickening, cytoplasmic changes and autolysis. **08h**

8. Stem : Secondary structure, Anomalous secondary growth in dicots and monocot. Wood: sap wood and heartwood, Reaction wood, growth rings and Nodal anatomy. Unifacial, bifacial and centric leaf (onion); structure of epidermis. **08h**

III SEMESTER SYLLABUS

CHOICE BASED CREDIT SYSTEM

HARD CORE-1 : PRACTICAL

BO3-506 : TECHNIQUES IN PLANT SCIENCES AND ANATOMY

1. Determination of spores/ pollen grains dimension by Micrometry.
2. Determination of spores/pollen grain count using haemocytometer.
3. Pigment separation of paper chromatography.
4. Amino acid analysis by paper chromatography.
5. Separation of chemicals based on size/ charges by column chromatography.
6. Protein separation by PAGE.
7. DNA amplification by PCR.
8. Staining of pollen grain, bacteria and fungi.
9. Free hand sectioning and double staining of plant tissue.
10. Spore trapping by air samplers.
11. Study of chromatograms (HPLC, NMR, IR, MS)
12. Killing, fixing and staining of plant tissues: Important reagents and chemicals used in the preparation of fixatives and their properties.
13. Fixatives - FAA, Carnoy's fluid, chrome acetic, Nawaschins fluid, Craf, Flemings- composition, preparation and specific uses.
14. Dehydrating agents, clearing agents, mounting medía. Examples and brief description.
15. Stains - classification, composition and specific uses - safranin, crystal violet, cotton blue, fast green, Orange - G, hematoxylin, carmine.
16. Brief account of vital staining. Staining techniques - Double staining: Saffranin, Fast green, Crystal violet, Orange G
17. Methods of embedding plant materials in paraffin wax - TBA method

References

1 Johansen. **Botanical Microtechnique.**

2 Easu, E. **Plant Anatomy.** Wiley Eastern Pvt. Ltd., New Delhi.

3 Bierhost. **Morphology of Vascular Plants**.

4 Pandey B.P. 1993. **Plant Anatomy.** S. Chand and Co, New Delhi.

III SEMESTER SYLLABUS

CHOICE BASED CREDIT SYSTEM

PLANT PHYSIOLOGY AND METABOLISM

Hard Core-2 **(Credits – 4)**

Paper Code-BO3-502 **64 Hours**

THEORY

Objectives: To understand the concepts involved in the function of plants and study the recent aspects of various physiological processes in plants.

Unit-1 : Water relationship: A general account of the movement of water into, through and out of plant. Mechanism of stomatal opening. Physiological change under water stress, salt stress, low and high temperature stress. **04h**

Unit-2 : The Plasma Membrane**:** Structure, models of membrane lipids and proteins, their organization and inter-action. Membrane transport. Membrane potential-electrogenic ion pumps; voltage-gated and ligand-gated channels. **04h**

Unit-3 : Organization and Function of Endomembrane System **:** Methods of isolation and study of the different components of the endomembrane systems. Endoplasmic reticulum **:** Role of endoplasmic reticulum in the biosynthesis and secretion of extra-cellular molecules. The Golgi apparatus**:** Role of Golgi apparatus in membrane flow and secretion. Microbodies : Metabolic pathways in glyoxisomes and peroxisomes. **08h**

Unit-4 : Energy Conversion and Related Processes: Mitochondrion: Krebs cycle and its regulation. Carrier sequence in the electron transport chain. Electrochemical proton gradient and the mechanism of energy coupling. The use of inhibitors and uncouplers in the study of energy transduction. Ion and substrate transport across the mitochondrial membrane Bio-genesis of mitochondria. **08h**

Unit-5 : Chloroplast: Photsynthetic electron transport: cyclic and noncyclic. The mechanism of photophosphorylation. Biogenesis and molecular organization of electron transport components, CF**1** subunits and RUBISCO, Calvin cycle, C**4** pathway, CAM and photo-respiration Carbohydrates-their classification, chemistry and metabolism. **04h**

Unit-6 : Enzymes :Nature and properties of enzymes. Mechanism of enzyme action. A brief account of enzyme kinetics-Michaelis-Menten equation, Linewqaver-Burk plot, kineties of enzyme inhabitation, Beer and Lambarts law, multisubstrate reactions. Allosteric enzymes and feed-back contract. Extraction and purification of enzymes. **04h**

Unit-7 : Glycolytic reactions and gluconeogenesis. Sucrose synthesis and utilization. Oxidative pentose phosphate pathway. Fatty acid biosynthesis. Nitrogen metabolism **:** Nitrate reduction. Symbiotic nitrogen fixation. Mechanism of nitrogen fixation. The involvement of hydrogenase and the role of leghemoglobin in dinitrogen fixation. Sulfate metabolism- Sulfate uptake and assimilation. Secondary metabolites – Alkaloids and steroids, flavonoids and phenols. **08h**

Unit-8 : Nucleic Acid and Proteins **:** The process of transcription and its regulation. Protein bio-synthesis and its regulation in cytosol and organelles. Restriction endonuleases. Strictures of protein, primary, secondary and tertiary. **08h**

Unit-9 : Plant Growth Regulators **:** Analysis, biosynthesis, transport and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid. The concept of hormone sensitivity. Hormone receptors in plants. Role of calcium, calmodulin and other regulatory molecules in hormone action. Hormonal regulation of gene expression in plants. Signal transduction, overviews, specific signal mechanisms- two component sensor-regulator system in bacteria and plants, sucrose sensing mechanisms **08h**

Unit-10 : Sensory photobiology: Phytochromes and cryptochromes and their photochemical and biochemical properties, photophysiology of light induced responses, cellular localization, molecular mechanism of action of photomorphogenic receptors. Plant Rhythms and biological clock, Physiology of flowering: Photoperiodism and its significance, floral induction and development – genetic and molecular analysis, vernalization, seed and bud dormancy, methods of overcoming dormancy. **08h**

III SEMESTER SYLLABUS

HARD CORE-1 PRACTICALS

Code-BO3-507- PLANT PHYSIOLOGY AND METABOLISM

1. Measurement of water potential
2. Effect of temperature on protoplasmic membrane
3. Separation of chloroplast pigments and amino acid by Paper chromatography
4. Extraction of proteins from different plant organs & estimation
5. Effect of light and potassium ion on stomatal opening
6. Extraction of estimation and total phenolic compounds
7. Estimation of chlorophyll content
8. Demonstration of carbon dioxide fixation by estimating the dry matter yield
9. Extraction of enzymes for plant tissues and study the effects of :

    a. pH b. Temperature

    c. Substrate concentration d. Enzyme concentration

    e. Inhibitors f. Promoters

10. Isolation of mitochondria and estimation of succinate dehydrogenase
11. Experiments to demonstrate the Crassulacean acid metabolism
12. Estimation of proline content in stressed plants
13. Extraction and estimation of IAA oxidase from the tissues
14. Effect of monochromatic light on photosynthesis
15. Effect of CO_2 concentration of the rate of photosynthesis

References

1. Salisbury F. B. and C.W Ross. 1986. **Plant Physiology.** Wadsworth Publishing Co.
2. Noggle, G.R. and G.J. Fritz. 1983. **Introductory Plant Physiology.** Prentice Hall.
3. Stupf, P.K. and E.E. Conn. 1981. **The Biochemistry of Plant.** Vol. 1-8. Academic Press.
4. Wilkins, M.B. 1984. **Advanced Plant Physiology.** Pitman Publishing Co.
5. Douce, R. 1985. **Mitochondria in Higher Plants: Structure, Function and Biogenesis.** Academic Press.
6. Davios, D.D. 1987. **The Biochemistry of Plants.** Academic Press.
7. Thompson, W.W. Mudd, J.B. and M. Gibbs. 1983. **Biosynthesis and Function of Plant Lipids.** *Amer. Soc. Plant Physiol.*.
8. Timmermann, B.N. Steelink, C. and F.A. Loewus. 1984. **Phytochemical In-adaptions to Stress.** Plenum Publ.
9. Bewley, J.B. and M. Black. 1982-83. **Physiology and Biochemistry of Seeds in Relation to Germination.** Vol. 1-2. Springer-Verlag.
10. Bhojwani S.S. and Bhatnagar, S.P.1977. **The Embryology of Angiosperms.** New Delhi.
11. Bhojwani, S.S. and Rayden, M.K.1983. **Plant Tissue Culture Theory and Practice.** Elsevier, Amsterdam.
12. **Annual Reviews of Plant Physiology** (Published every year).
13. Raghavan, V. 1976. **Experimental Embryogenesis in Vascular Plants.** McGraw Hill, New York.
14. White, P.R. 1963. **Cultivation of Animal and Plant Cells.** Ronald Press Co.
15. Steward, F.C. 1969. **Plant Physiology - A Creation.** Vol. 513. Acad. Press, New-York.
16. Lincoln Taiz and Eduardo Zeiger. 1998. **Plant Physiology.** Sinaur Associates, Inc., Sunderland, Massachusetts.
17. Hopkins, W. G. 1999. **Introduction to Plant Physiology.** John Wiley and Sons Inc., New Delhi.
18. Trivedi., P.C. 2006 **Advances in Physiology.** I.K. International Publishing House Ltd., New Delhi.
19. Buchanan, B.B. 2007. **Biochemistry and Molecular Biology of Plants**. I.K. International Publishing House Ltd., New Delhi.

III SEMESTER

CHOICE BASED CREDIT SYSTEM

SOFT CORE 1 (CREDITS – 4)

MOLECULAR PLANT PATHOLOGY

BO3-508: **64 Hours**

Unit-1 : Genetics of plant pathogen interaction; resistance and susceptibility, antigen hypothesis, vertical and horizontal resistance, mutations, heterokaryosis, adaptation, saltation, cytoplasmic variation, sexual recombination, interferons. **08h**

Unit-2 : Resistance genes – Gene for gene resistance, cloned resistant genes, R-genes, co-evaluation of resistant genes, Recessive resistant genes and quantitative resistance. **08h**

Unit-3 : Induced resistance in plants – Localized induction of resistance, systemic induction of resistance to disease, mechanisms of induced resistance – role of phytoalexins, activation process of the inducing sites, signal translocation, role of lucanohydrolysis, hydroxy proline rich lipoproteins, other possible mechanisms (aromatic compound synthesis, elicitors, modification of plant metabolism, wound responses), some examples of study of induced systemic resistance by PGPR, PGPF, viruses and pathogenic fungi. **12h**

Unit-4 : Application of molecular biology in conventional disease control strategies – breeding for resistance (the basis for resistance breeding programs, and conventional breeding strategies), molecular markers for the development of disease resistance, molecular biology in agrochemical production and engineering chemicals that elicit defense responses in plants. **12h**

Unit-5 : Transgenic approaches to crop protection – Pathogen derived resistance (coat protein mediated resistance, replicase mediated resistance, movement protein mediated resistance, RNA – mediated resistance, pathogen derived resistance against bacterial and fungal diseases), over expressing defense genes, use of cloned resistance gene, broad spectrum resistance engineering, resistance based on antagonistic microbes and expression of vaccines in plants. **08h**

Unit-6 : *Arabidopsis thaliana*, a model plant for studying plant pathogen interaction – activated defense mechanisms and their genetic analysis, systemic acquired resistance and its elucidation. **08h**

Unit-7 : Application of tissue culture in plant pathology – Protoplast fusion in fungi- its importance, techniques of hybridization- commercial applications of fungal protoplast fusion, explant culture for screening antiviral products, generation of disease resistant plants by inducing somaclonal variations. **08h**

CHOICE BASED CREDIT SYSTEM – III SEMESTER

SOFT CORE I - PRACTICALS

BO3-508: PRACTICALS - MOLECULAR PLANT PATHOLOGY

1. Experiments on seed disease management by physical, chemical and biological methods.
2. Determination of susceptible and resistant crop plants in farmer's field.
3. Estimation of poly phenol contents in diseased materials.
4. Identification of lignin in diseased leaves by staining and other methods.
5. Determination of peroxidase and polyphenol oxidase activity in resistant and susceptible plant materials.
6. Isolation of bacteria and fungi and test for their ability to induce resistance in plants.
7. Determination of chitinase activity in plant tissues.

References

1. Hess, W.M., Singh, R.S., Singh, V.S. and D.J. Weber. 1988. **Experimental and Conceptual Plant Pathology.** Vol. I, II and III, Gordon and Breach Science Publ. New York.
2. Dickinson, M. 2003. **Molecular Plant Pathology.** BIOS Scientific Publ. London.
3. Andrews, J.H. and I.C. Tommerup. 1993. **Advances in Plant Pathology.** Vol. 10, Academic Press, London.
4. Hammerschmidt, R. and Jeseph Kuc. 1995. **Induced Resistance to Diseases in Plant.** Kluwer Academic Publ., London.
5. Bollar, T. and F. Meins (1993). **Genes involved in plant defense.** Springer-Verlag wyen, New York.
6. Vidyasekran, P. (1993). **Genetic engineering, molecular biology and tissue culture.** Daya Publishing House, New Delhi.
7. Day, P.R. (1992). Plant pathology and biotechnology: Choosing your weapons. **Annu. Rev. Phytopathol., 30: 1-31.**
8. Kinghorn, J.R. and G. Turner (1992). **Applied molecular genetics of filamentous fungi.** Blackie Academic and Professional, London.
9. Stahl, U. and Tudzynski P. (1992). **Molecular biology of filamentous fungi.** VCH Publishers Inc., New York.
10. Cook, R.J. (1993). Making greater use of introduced microorganisms for biocontrol of plant pathogens. **Annu. Rev. Phytopathol.,** 31: 53-80.
11. Henson, J.M. and R. French. (1993). The polymerase chain reaction and plant disease diagnosis. **Annu. Rev. Phytopathol.,** 31: 81-109.
12. Kistler, H.C. and Miao, V.P.W. (1992). New modes of genetic change in filamentous fungi. **Annu. Rev. Phytopathol.,** 30: 131-152.

CHOICE BASED CREDIT SYSTEM – III SEMESTER
SOFT CORE 2 - PRACTICALS
BO3-509: BIODIVERSITY CONSERVATION AND MANAGEMENT

THEORY
SOFT CORE 2 (CREDITS – 4)

BO3-504: **64 h**

1. Conservation of Plant resources- concept of conservation, the philosophy and ethics of conservation. Plant diversity in India - a brief account of diversity of major groups of plants (Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms). Ecosystem diversity, species diversity, genetic diversity, and loss of biodiversity, Hotspots of biodiversity. **8h**

2. International organizations for biodiversity conservation- IUCN, Species survival commission (SSC), convention on biological diversity (CBD), CITES, TRAFFIC, WWF. Plant genetic resources: Conservation, gene bank- methods, types, NBPGR, IPGR. **12h**

3. Threats to biodiversity - Human population growth, Habitat loss, Pollution, Introduced species, Fires, Diseases, Overexploitation, Genetically modified organisms, Infrastructure projects. **08h**

4. Monitoring - Sampling methods and analysis, Quadrates and Transects, long term and large scale monitoring, Species composition, abundance, species richness and diversity indices. History and nature of EIA, The EIA process, Baseline surveys and Environmental Impact Assessment (EIA). **12h**

5. Management of natural habitats- Protected area network, Biosphere reserves, National parks and sanctuaries, the acts related to plant resource conservation. Management of species- Meta population, *ex-situ* conservation and *in-situ* conservation, sustainable utilization of plant resources. **12h**

6. Restoration biology- Reintroduction of species, obstacles and guidelines for introduction, vegetative propagation and tissue culture methods for re-introduction; control of introduced species. **12h**

CHOICE BASED CREDIT SYSTEM - III SEMESTER
SOFT CORE II - PRACTICALS

BO3-509: PRACTICALS - BIODIVERSITY CONSERVATION AND MANAGEMENT

1. Determination of density, abundance, frequency in plant communities.
2. Assessment of basal area of a small patch of forest.
3. Determination of species diversity (α- diversity) index in plant community.
   a. Shannon–wiener
   b. Simpson etc.
4. Measurement of similarity index (β- diversity) in two different plant communities by a) Jaccard measure (Qualitative), 2) Morista Horn (Quantitative)
5. Determination of Importance Value Index (IVI) of plant species in plant community by quadrate, line and belt transect methods.
6. Visit to a meteorological station, sanctuary, national park and preparation of a report.

References

1. Ramakrishna, P.S. 1991. **Ecology of Biological innovation in the Tropics.** National Trust of Ecology and International science Publication, New Delhi.
2. Ramakrishna, P.S., Das, A.K. and K.G. Saxena. 1996. **Conserving Biodiversity for Sustainble Development.** INSA, New Delhi.
3. Kormondy, E.J. 1996. **Concepts of Ecology.** Prentice Hall, Eagle Wood Cliffs, NI.
4. Odum, E.P. 1971. **Fundamentals of Ecology.** WB Saunders Co., Philadalphia.
5. Whitmore, T.C. 1996. **An Introduction to Tropical rain Forests.** Clarendon, Oxford.
6. Stephan H Bullock, Mooney, H.A. and E. Medina. 1995. **Seasonally dry tropical forests**. Cambridge University Press, London.
7. Spellerberg, I.F. 1991. **Monitoring Ecological Change.** Cambridge University Press, Cambridge.
8. Hambler, C. 2004. **Conservation**. Cambridge University Press.
9. Southwood, T.R.E. and Henderson. 2000. **Ecological methods.** Blackwell Science Ltd., Oxford.
10. Pandey, A.K. (ed.) 1995. **Taxonomy and Biodiversity.** CBS, New Delhi.
11. Khoshoo, T.N. 1994. India's Biodiversity Tasks a need. **Curr. Sci.,** 67: 577-582.
12. Myers, N. 1990. Threatened Bio and as 'hot spots' in tropical forests. **The Environmentalists,** 8: 187-2008.
13. Myers, N. 1990. The Biodiversity Challenge Expanded Hot spot analysis. **The Environmentalists,** 10: 243-255.
14. Ramakrishnan, P.S. 2004. **Ecology and Sustainable Development.** NBT, New Delhi.
15. Pielon. 1975. **Ecological Diversity.** Wiley Interscience, USA.

CHOICE BASED CREDIT SYSTEM -III SEMESTER

PHYTOCHEMISTRY AND PHARMACOGNOSY OF MEDICINAL PLANTS

SOFT CORE –3 (CREDITS – 4)

THEORY

BO3-505 **64 Hours**

Unit-1 : Concepts of plant drug in modern medicine - use of plants in the management of health and disease. The *Alama-Ata* – declaration, WHO, need for the study of herbal plants and herbal medicine. Identification and exploration of new therapeutically active molecular models in plants; understanding mode of action, synthesis and designing of herbal drugs, pharmaco-dynamics, improvement of drugs. **12h**.

Unit-2 : Phytochemistry **–** Introduction and general methods (extraction of plant material, separation and isolation). Methods of investigation in Biogenetic studies (Tracer techniques); Basic metabolic pathways and the origin of secondary metabolites (enzymes, chemical nature, coenzymes, classification of enzymes). **08h.**

Unit-3 : Plant biosynthetics and importance of secondary metabolites **–** some examples of secondary metabolites of commercial importance as anticancer and antidiabetic drugs and vaccines. **08h.**

Unit-4 : Analytical pharmacognosy – drug adulteration and substitution of crude drugs. Detection of adulteration and evaluation. Biological detection of adulterations and evaluation, biological testing of herbal drugs, techniques in microscopy, powered drugs, the microcomputer as analytical aid in drug microscopy, quantitative microscopy. **12h.**

Unit-5 : Marketing potential of medicinal plants, market potential (export and import) of crude drugs and their product -Collection, preparation storage and packing of crude drugs for the market, Trade (Export, import) of crude drugs and phytochemicals, International and domestic consumer marketing, Problems in marketing, Steps to boost marketing of medicinal plants. **12h.**

Unit-6 : IPR issues- patents, patenting of biological material, trade secret, copy right, trademark, IPR and plant genetic resource, obligations with patent applications, implication of patenting, patenting of medicinal plants- turmeric and neem. **12h.**

B03-510: SC 3: PRACTICALS: PHYTOCHEMISTRY AND PHARMACOGNOSY OF MEDICINAL PLANTS

1. Phytochemical assay of medicinal plants – tannin, caffeine, alkaloids, saponins, glycosides, carotenoids.
2. Extraction and quantification of aromatic plant parts by soxhlet method.
3. Detection of adulteration.
4. Substitution of crude drugs.

References

1. Acharya, Y.T. (ed.) 1941. **Charakasamhitha.** Commentary by Chakrapani, Niranya Sagar Press, Bombay.
2. Aggarwal, V.S. and B. Ghosh. 1985. **Drug plants of India (Root Druga)**. Kalyani Publishers, New Delhi.
3. Ambasta, S.P. (ed.) 1988. **The useful plants of India.** CSIR, New Delhi.
4. Anonymous. 1922. **Five hundred Indian plants and their use in medicine and in the arts (In Karnataka).** 3rd Edition, Kanarese mission press, Mangalore.
5. Anonymous. 1948. **The Wealth of India.** CSIR, New Delhi.
6. Anonymous. 1922. **Five hundred Indian plants, their use in medicine and in the arts (in Karnataka).** 3rd edition, (1st ed. 1881) Kanarese Mission Press, Mangalore.
7. Aobarya, Y.T. (ed.) 1941. **Charaka Samhita.** commentary by chakrapani, Niranya Sagar Press, Bombay.
8. Kokatae, C.K., Purohit, A.R., Gokhale, S.B. and D.K. Furia. 1990. **Pharmocognosy**. Niraliprakashan, Pune.
9. Chopra, R.N., Nayar, S.L. and I.C. Chopra. 1956. **Glossary of Indian Medicinal Plants.** CSIR, New Delhi.
10. Cotton, C.M. 1996. **Ethnobotany, Principles and Applications.** John Wiley, New York.
11. Gopalan, C., Ramasastri, B.V. and S.C. Balasubramanian. 1985. **Nutritive Value of Indian Foods.** National Institute of Nutrition, Hyderabad.
12. Hughes, C.C. 1968. **Ethno medicine. In International encyclopedia of social sciences.** MacMillan, New York, Vol. 10.

13. Iyengar, M.A. 1991. **Study of crude drugs**. Director and Publishers, KMC Manipal.

14. Qadry, J.S. and Qadry, S.Z. 1981. **A text book of inorganic pharmoceutical and medicinal chemistry.** Popular Prakashan, Mumbai.

15. Jain, S.K., Sinha, B.K. and R.C. Gupta. 1991. **Notable plants in ethno medicine of India.** Deepa Publications, New Delhi.

16. Tripathi, K.D. 1985. **Essentials of medical pharmacology.** Jaypee Brothers Medical Publishers Pvt. Ltd., Daryaganj, New Delhi.

17. Kapoor, S.L. and R. Mitra. 1980. **Herbal drugs in Indian pharmaceutical Industry.** NBRI, Lucknow.

18. Kirtiikar, K.R. and B.D. Basu. 1933. **Indian Medicinal plants.** Allahabad.

19. Martin, G.J.1995. **Ethnobotany**. Chapman and Hall, London.

20. Nadkarni, A.K. 1954. **Indian Materia Medica.** Vol. II, Popular Prakashan, Bombay.

21. Parimoo, P. 1998. **Pharmoceutical analysis.** C.B.S. Publishers and Distributors, Daryaganj, New Delhi.

22. **Quality assurance of pharmaceutical. A compendium of guidelines and related materials.** Vol. I, Pharma Book Syndicate, World Health Organization, Geneva.

23. **Quality assurance of pharmaceutical. A compendium of guidelines and related materials.** Vol. II, Pharma Book Syndicate, World Health Organization, Geneva.

24. Satoskar, R.S., Bhandarcar, S.D. and S. Saniapure. 1969. **Pharmocology and pharmocotherapeutics.** Revised 17 Edition, Popular Prakashan, Mumbai.

25. Ramachandra Rao, S.K. 1983. **Glossary and medicinal plants of Karnataka.** Panchabootha Bhagheerathi Associations, Bangalore.

26. Sengupta, N. (ed.) 1959. **Sushrutha Samhitha** commentary by dalharna C.K. Sen and Co., Calcutta.

27. Sethi, P.D. 1997. **Quantitative analysis of drugs in pharmaceutical formulations.** CBS Publishers and Distributors, Daryaganj, New Delhi.

28. Wagner, Bladt, Springer-verlag, Berlin and Heidelber. 1996. **Plant drug analysis.** Printed and Bound by Thomson Press (India) Ltd.

29. William Charles Evans. 1989. **Trease and Evan's Pharmocognosy.** English language Book Society/ Bailleere Tindall.

CHOICE BASED CREDIT SYSTEM - III SEMESTER
INTER DISCIPLINARY ELECTIVE –

BO3-511 : BIOFERTILIZERS AND BIOPESTICIDES (CREDITS – 2)

16 Hours

Unit-1 : Biofertilizers: Introduction and scope. symbiotic nitrogen fixers: Root nodules, organisms and their host specificity, life cycle, Organisms and their importance. Symbiotic and A symbiotic nitrogen fixation. **02h**

Unit-2 : Algal fertilizers: BGA, Azolla, occurrence and agronomic significances, Heterocyst and nitrogen fixation, possible new symbiotic association **02h**

Unit-3 : Phosphate solublizing bacteria and PGPR, siderophores and their importance, PGPF and its importance. **01h**

Unit-4 : Mycorrhiza- Biology of ecto and endomycorrhiza, VAM and their importance, phosphate uptake, present and future value of mycorrhizal inoculants. **02h**

Unit-5 : Organic fertilizers: Animal wastes, crop residues, garbages, sewage effluents, oil cakes, pressmud, fly-ash and their utilization. **01h**

Unit-6 : Microbial inoculants of crop plants in agrochemical industry, current commercial status of microbial products, barriers in their commercialization, and market opportunities. **02h**

Unit-7 : Biopesticides, importance, kinds of biopesticides. Biological control – Advantages, bacterial and fungal agents. Plant viruses as inoculants- Crop protection and inducing resistance in plant. Bio-insecticides: BT in cotton and other crops, commercial formulation, nuclear polyhydrosis virus. **04h**

Unit-8 : Genetically engineered microbial agents, importance and applications, fitness of genetically altered microbial agents, ecological considerations; problems of introducing genetically engineered agents, regulatory system. **02h**

References

1. Postage, J. 1998. **Nitrogen fixation.** 3rd Edition, Cambridge University press, Cambridge.

2. Deshmukh, A.M. 2003. **Biofertilizers and Biopesticides**. ABD Publishers, Jaipur. India.

3. Subba Rao, N.S. 1998. **Biofertilizers in Agriculture.** Oxford and IBH Publ. Co., New Delhi.

4. Gaur, A.C., Neelakantan, S. and K.S. Dargan. 1984. **Organic manures.** 2nd ed., ICAR, New Delhi.

5. Cook, R.J. 1993. **Making grater use of introduced microorganisms for biocontrol of plant pathogens.** Annual Review of *Phytopathol*., 31: 53-80.

6. Gupta, P.K. 1994. **Elements of biotechnology.** Rastogi and Campany. Meerut, India.

7. Dubey, R.C. 1996. **A textbook of Biotechnology.** S Chand and Company Ltd., New Delhi.

8. Trivedi *et al*. 1989. **In plant microbe interactions** (Biligrame, K.S. ed.), Focal theme (Botany), ISCA Symposium, Narendra Publication house, New Delhi.

CHOICE BASED CREDIT SYSTEM -IV SEMESTER
HARD CORE –1 (CREDITS – 4)
THEORY

BO4-551 **64 Hours**

HARD CORE-1 : GENETICS AND PLANT BREEDING

OBJECTIVES: This paper is aimed at understanding the basic concepts of genetics, helping students to develop their analytical, quantitative and problem-solving skills of genetics.

Unit-1 : Introduction and scope of genetics. Laws of Inheritance (Diploid organism- Pea, Haploid organism- *Chlamydomonas*/*Neurospora*), Interaction of Genes, Multiple alleles, Multigenic inheritance, cytoplasmic inheritance. **08h.**

Unit-2 : Classical gene concept: Fine structure of genes, Split genes. - Introns and Exons, overlapping genes. Chromosome structure and functions, linkage, maps, genetic and cytological mapping of chromosomes. Chromosome number (euploidy, monoploidy, polyploidy- autopolyploidy, alloploidy). **08h.**

Unit-3 : Sex linked inheritance, characteristics of sex linked inheritance, examples of X-linked gene inheritance and Y-linked gene inheritance. Extra nuclear inheritance: Variegation in 4 'O' clock plant, Lojop in Maize, Poky in Neurospora, Petite in *Sacharomyces* and inheritance of episome in eukaryotes. **08h.**

Unit-4 : Mutations: spontaneous and induced mutations, physical and chemical mutagens, molecular basis of gene mutations, transposable elements in eukaryotes and prokaryotes, mutations induced by transposons, site directed mutagenesis, DNA damages and repair mechanisms, inherited human diseases and defects, agro-infection **08h.**

Unit-5 : History and scope of plant breeding, breeding systems in crop plants, techniques and methods of plant breeding. **04h.**

Unit-6: Breeding self-pollinated and cross-pollinated crops by introduction, selection, and hybridization., selection, principles of selection, types of selection. **08h.**

Unit-7: Methods of breeding: hybridization- pedigree method, bulk method, back cross, procedures, advantages of incompatibility, male sterility, barriers to cross sterility. **08h.**

Unit-8: Breeding for disease and insect resistance, history, loss of resistance, race and its identification, classification of resistance, genetics of host- parasite interaction, breeding for disease resistance, explanation of resistance genes, advantages and limitations of resistance breeding. **08h.**

Unit-9: Mutation breeding- Definition and history, classification of mutation and mutagens, procedure for mutation breeding in self-pollinated crop, cross-pollinated crops, applications and achievements. Heterosis or hybrid vigour-Types of heterosis, causes of heterosis, breeding methods to exploit heterosis, technique of producing hybrid seed **08h.**

CHOICE BASED CREDIT SYSTEM -IV SEMESTER

(CREDITS – 2)

B-551

HARD CORE-1 : GENETICS AND PLANT BREEDING - PRACTICAL

1 Mendelian Genetics: Problems on monohybrid, di hybrid and tri hybrid crosses. Multiple allels, cytoplasmic inheritance, epistasis, sex linked inheritance. Laboratory exercises in probability and chi-square; Demonstration of genetic principles using laboratory organisms; Chromosome mapping using three point test cross; Tetrad analysis; Induction and detection of mutations through genetic tests.

2 Selfing and hybridization techniques in Bajra, maize and Sorghum.

3 Floral biology of Bajra and Maize.

4 Estimation of pollen viability and pollen size.

5 To study stigmatal receptivity and pollination period in self-pollinated crops.

6 To determine LD 50 value for certain chemical mutagens.

7 To test seed viability by TTC method.

8 B-chromosomes and polytene chromosomes.

References:

1. Stickberger, M.W. 1977. **Genetics**. 2nd Ed., Macmillan, New York .
2. Swanson, C.P., Mertz, T. and W.J. Yound. 1988. **Cytogenetics**. 2nd Englewood Clifa, New Jersey.
3. Watson, J.P. 1975. **Molecular Biology of the Gene.** 3rd Ed., Benjamin, New York.
4. Darlington, C.D. 1985. **Cytology**. Churchill, London.

5. Henry, R.J. 1997. **Practical Applications of Plant Molecular Biology.** Chapman & Hall, London, UK.

6. Old, R.W. and S.B. Promrose. 1989. **Principles of Gene Manipulation.** Blackwell Scientific Publications, Oxford, UK.

7. Chawla, H.S. 2002. **Plant biotechnology.** 2nd Ed., Oxford IBH Publishing Co. Pvt. Ltd., New Delhi.

8. Primrose, S.B. 1995. **Principles of Genome Analysis.** Blackwell Science Ltd., Oxford, U.K.

9. Raghavan, V. 1997. **Molecular Biology of Flowering Plants.** Cambridge University Press, New York, USA.

10 George M. Malacinski. 1986. **Molecular Genetics of Mammalian cells.** MacMillan Publishing Co., New York.

11 Tobin, A.K. 1992. **Plant organelles comportmentation of Metabolism in Photosynthetic tissue.** Cambridge University, Press.

12. Bhamaah, H.S. 1990. **Molecular cell Biology**. Anmol Publication, New Delhi.

13. Rogerl Miesfeld. 1999. **Applied Molecular Genetics**. Wiley's Liss Publication.

13. Rastogi, S.C. 1995. **Concepts in Molecular Biology.**

14. Reeta Arora. 1998. **Cell Biology.** Anmol Publications, New Delhi.

15. Shanmugam, G. 1998. **Cell Biology Lab Manual.** MacMillan India Ltd., Madras.

16. Sharad Srivastava. 1997. **Molecular Genetics,** Anmol Publication, New Delhi.

17. Madhusudan W Pandit. 2007. **Scientoonic Tell-Tale of Genome and DNA.** International Publishing.

18. David A. Micklos. 2005. DNA Science: A First Course, Second Edition V

19. Michael Wink. 2006. **An Introduction to Molecular Biotechnology: Molecular Fundamentals, Methods and Applications in Modern Biotechnology.** Springer Publishing Company.

20. Nick Talbot. 2005. **Molecular and Cellular Biology of Filamentous Fungi: A Practical Approach**. Oxford,

21. Rakesh K. Mishra. 2009. **Chromosomes to Genome.** I.K. International Publishing.

CHOICE BASED CREDIT SYSTEM -IV SEMESTER

HARD CORE –2 : MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY
(CREDITS – 4)

THEORY

Code: BO4-552 **64 Hours**

Objectives :. The objective of this paper is to acquire fundamental knowledge on the application of biotechnology tools and techniques for improvement of microbes and higher plants. To explain how genetic engineering involves the use of recombinant DNA technology for crop improvement and to identify the molecular markers for selection of superior genotypes.

Unit-1 : Information transfer: introduction to nucleic acids- models, evidences to prove DNA and RNA as genetic material, DNA replication. Regulation of gene action in prokaryotes – transcriptional control mechanism. Gene expression- operon concept, concept of gene expression in prokaryotes and eukaryotes. **08h**.

Unit-2 : Recombinant DNA technology, molecular probes, southern, northern and western blotting; dot and slot blots; construction and screening of genomic and c DNA libraries; chromosome walking . Polymerase Chain Reaction (PCR) and Gene Amplication: RT-PCR **08h**.

Unit-3 : Isolation, Sequencing and synthesis of DNA: Isolation of genes, sequencing of genes or a DNA segment (Maxam, Gilbert's and Sanger's methods); synthesis of genes; gene synthesis machines. **04h**.

Unit-4 : Gene transfer methods in plants: target cells for transformation; vector for gene transfer (based on Ti and Ri plasmids; binary vectors; viruses as vectors); gene transfer techniques using *Agrobacterium*: selectable and score able markers (reporter genes); agroinfection and gene transfer; physical delivery methods, DNA mediated transfer (DMGT), PEG simulated, microinjection microprojectile or particle gun, electroporation. **08h**.

Unit-5 : Molecular Maps of nuclear, chloroplast and mitochondrial Genomes: RFLP genetic maps in plants (techniques and present status); linkage of major genes and QTLs to RFLPs; uses of RFLP maps; cytogenetic RFLP maps using aneuploids; RAPD's and SSRs, most recent markers, crop improvement and gene tagging; physical maps using *in situ* hybridization (ISH); resolution gap. Human and rice genome projects and its importance. GM crops - GM foods and their relevance **08h**.

Unit-6 : Immunotechnology: Hybridoma and monoclonal antibodies: Hybridoma technology and production of monoclonal antibodies; antibody engineering using genetic manipulation (Fv, Fab, Fc); alternative to hybridoma technology; production of human and humanized antibodies; uses of monoclonal antibodies (diagnosis, imaging, therapy, vaccines, enzymes, etc.). **08h**.

Unit-7 : Introduction-Scope and importance of tissue culture techniques. Basic aspects of plant tissue culture, Tissue culture media components, Growth regulators, Growth retardants, Vitamins, Amino acids, undefined supplements, Explants, sterilization, inoculation, sub-culturing, Totipotency. **04h**.

Unit-8 : Different types of cultures, callus formation, different types of suspension cultures, single cell culture, Testing of viability of cells, organogenesis-different types, factors affecting, somaclonal variation and its importance, Somatic embryogenesis - different methods, factors affecting embryo maturation, application of somatic embryogenesis, synthetic seeds - its significance. Protoplast isolation and culture, factors affecting. Protoplast fusion and somatic hybridization, Fusion methods, fusion products, cybrids, applications of protoplast fusion. **08h**.

Unit-9 : Different types of secondary metabolites, production, factors, affecting yield, Biotransformation, different types with examples, immobilization techniques and advantages, biosensor and biochips. Production of pathogen free plants, different methods, meristem culture and its importance in commercialization, development of disease- free tissue cultureplants. **04h**.

Unit-10 : Intellectual property: Intellectual property rights (patents, trade secrets, copyright, trademarks); choice of intellectual property protection; IPR and plant genetic resources (PGR); GATT and TRIPs, patenting of biological material; International applications, implications of patenting, patenting of turmeric and neem, patenting transgenic organisms and isolated genes; patenting of genes and DNA sequences. **04h**.

CHOICE BASED CREDIT SYSTEM -IV SEMESTER

HARD CORE –2 : B: 554: MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

PRACTICALS:

1. Determination of nodulation in cultivated and uncultivated legume crops.
2. Determination of protoplasm viability.
3. Estimation of citric acid produced by fungi.
4. Protoplast fusion by PEG treatment.
5. Techniques in plant biotechnology and study of tools / instruments.
6. Instruments:
   (a) Hot air oven
   (b) Autoclave
   (c) pH meter
   (d) Laminar air flow
   (e) Culture rack
   (f) Inverted microscope
   (g) Filtration unit
   (h)Accessories
7. Types of media and their constituents
8. Explant preparation – Monocot and Dicot
9. Media and explant sterilization.
10. T/S of root and shoot primordia.
11. Preparation of synthetic seeds
12. Isolation of protoplast and viability testing
13. Micropropagation – stem, leaf, meristem, flower bud, haploid culture (anther), embryo culture.

14 Instruments:
   a. Electron microscope
   b. PCR unit
   c. Gel documentation
   d. Isoelectric focusing
   e. Protein / amino acid analysis
   f. DNA synthesizer
   g. Column chromatography
   h. ELISA

15. Enzyme as a function of its pH
16. Enzyme as a function of its concentration
17. Assay of lipase activity
18. Isolation of DNA
19. Estimation of protein
20. Estimation of ascorbic acid
21. Estimation of amylase activity
22. Secondary metabolite extraction and detection of antifungal secondary metabolites produced by plant tissues.
23. Polyacrylamide electrophoresis of proteins, Blotting techniques.

24 DNA, RNA and protein sequencing methods.

References

1. Mather and J.L. Kand Jinks. 1982. **Biometrical Genetics.**Chapman and Hall.

2. Perelman, J.M. 1987. **Breeding Field Crops.** AVI. Pub.co.

3. Swaminathan, M.S., Guptha, P.K. and U. Sinha. 1982. **Cytogenetics of crop plants.** Macmillan India.

4. Singh, P. 1996. **Essentials of plant breeding**. Kalyani pub.

5. Vavilov, N.I. 1951. **The origin, variation, immunity and breeding of cultivated plants,** Ronald Press Co., New York.

6. Sharma, J.R. 1994. **Principles and practices of plant breeding.** Tata McGraw Hill, New Delhi.

7. Chaudhary, R.C. 1984. **Introduction to plant breeding.** Oxford and IBH pub. Co., Pvt. Ltd., New Delhi.

8. Allard, R.W. 1996. **Principles of Plant breeding.** John Wiley and Sons.

9. Bajaj, Y.P.S. 1990. **Haploids in crop improvement.** Springer Verlag.

10. Chopra, V.L. 1989. **Plant breeding : Theory and Practice.** Oxford IBH.

11. Dubey, R.C. 1996. **A text book of Biotechnology.** HR Company Limited, New Delhi.

12. Lyndon, R.F. 1990. **Plant development the cellular basis.** Unwin Hyman Ltd. UK

13. Zimmerman, R.H. 1986. **Tissue culture as a plant production system for Horticulture crops.** Elmer Academy pub.

14. Bonga, J.M. and K.J. Durzan (eds.) 1987. **Cell and tissue culture in forestry.** Vol. I & II General Principles of Biotechnology. Martinus Jijhoff Pub. Lancaster).

15. Dodds, T.H. and W. Robertyes. 1985. **Expt in plant tissue culture.** 2nd Ed.

16. Reinert, J. and Y.P.S. Bajaj. 1977. **Applied and fundamental aspects of plant cell, tissue and organ culture.**

17. Razdan, M.K. 2004. **Introduction to plant Tissue culture.** Oxford and IBH Publishing Company, New Delhi.

M.Sc. First semester Examination-20----------

(CBCS Scheme)

Subject- Botany

PAPER-Hard core-1

BACTERIA, ALGAE, VIRUSES, FUNGI AND PLANT PATHOLOGY

Model Question Papers

Note : 1. Answer All Questions.
2. Write diagram wherever necessary.

Time : 3.00 hrs **Max. Marks : 75**

I. Define/explain the following **02 x 10 = 20**

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

II. Write Short notes on any Five of the following **05 x 5 = 25**

11.
12.
13.
14.
15.
16.
17

III. Answer any Three of the following **03 x 10 = 30**

18.
19.
20.
21.
22.

M.Sc. First semester Examination-20----------

(CBCS Scheme)

Subject- Botany

PAPER-Soft core-1- MYCOLOGY

Model Question Paper

Note : 1. Answer All Questions.

2. Write diagram wherever necessary.

Time : 3.00 hrs **Max. Marks : 75**

I. Define/explain the following **02 x 10 = 20**

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

II. Write Short notes on any Five of the following **05 x 5 = 25**

11.

12.

13.

14.

15.

16.

17

III. Answer any Three of the following **03 x 10 = 30**

18.

19.

20.

21.

22