

KARNATAK UNIVERSITY, DHARWAD

Post Graduate Department of Studies in Botany

SYLLABUS & ADMISSION RULES

For

M. Sc. (Botany)

(Choice Based Credit System)

w.e.f. 2008-2009

Admission rules

for

M.Sc. (Botany) Degree Course under

Choice Based Credit System (CBCS)

1.1. Duration of the Course:

The M. Sc. Degree Course is of two years duration, spread over four semesters each of four months duration.

1.2 (A) Eligibility for Admission:

B.Sc. Graduates of Karnatak University or of any other University recognized as equivalent there to with Botany as optional subject. The candidate should have obtained at least 45% of marks in optional subjects as well as in aggregate. Relaxation in respect of SC / ST / Cat-I etc. will be followed as per prevailing rules of the University.

(B) Admission:

- (i) **Intake:** 40 + 4 (but may vary from time to time with the permission from the University) for the first semester. This includes admission under enhanced fee structure. Other rules for admission are as per University notification from time to time.
- (ii) **Admission to other Semesters:** Students are allowed to take admissions to successive semesters under carry over benefit (COB) facility all the way from the first semester to fourth semester.

2. Attendance:

Every student must have at least 75% attendance in each of the courses (Theory & Practical) in each semester. Shortage of attendance will be dealt with as per the University rules from time to time.

3. Medium of Instruction:

The medium of instruction shall be in English.

4. Scheme of Instructions:

In the First three Semesters (I, II, III) there will be 3 Core Theory Papers of 4 credits each. In addition, in the I, II and III Semester there will be 3 Practical Papers of 2 credits each.

In IV Semester there will be 3 Core Theory Papers of 4 credits each including one special paper, 3 Practical Papers of 2 credits each and one project work of 6 credits.

In each of I, II, III Semesters there will be one Elective paper of 6 Credits. These elective papers have to be chosen by the students of other departments.

Our M. Sc. students have to take one elective of 6 Credits in each of I, II, III Semesters offered by other departments. Study tour of minimum of 5 days is compulsory.

5. Scheme of Evaluation:

Examination will be conducted at the end of each semester.

Each Core theory paper of credits 4 will have an examination of 3 hours and carrying maximum of 75 marks. Each Core practical will have examination of 3 hours duration and carrying 40 marks.

For each theory / practical of 4 and 2 credits, there will be an internal assessment test carrying 25 and 10 marks respectively.

Each elective paper will have examination of 3 hours duration carrying 75 marks, 3 hours practical of 40 marks and will have internal assessment test for 25 and 10 marks respectively.

6. All other rules and regulations not covered above are as per the University rules prevailing at that time.

M.Sc. COURSE IN BOTANY
CHOICE BASED CREDIT SYSTEM

Course Structure and scheme of Examination for M.Sc im Botany
M.Sc. Ist Semester

Sl. No	Paper code no and Title	Credits	No of hrs/week /Theory/ Practical	Duration of Exam. In hrs Theory/ Practical	Internal Assessment Marks/ Theory/ Practical	Marks at the end of Exams	Total Marks
	Core Subject						
1	Bot .CT 1.1 Microbiology & Phycology	4	4	3	25	75	100
2	Bot.C T1.2 Systematic Botany of Angiosperms	4	4	3	25	75	100
3	Bot .CT 1.3 Evol.Bio, Econ.Bot &Phy.geo	4	4	3	25	75	100
	Elective						
4	Bot.ET1.4 Biodiversity	4	4	3	25	75	100
	Prcacticals						
5	Bot.CP.1.1 Based on Bot.CT 1.1	2	4	4	10	40	50
6	Bot. CP1.2 Based on Bot.CT 1.2	2	4	4	10	40	50
7	Bot.CP 1.3 Based on Bot.CT 1.3	2	4	4	10	40	50
	Elective						
8	Bot.EP1.4 Based on Bot.ET1.4	2	4	4	10	40	50
	Total	24	32	28	140	460	600

M.Sc. IInd Semester

Sl. No	Paper code no and Title	Credits	No of hrs/week /Theory/ Practical	Duration of Exam. In hrs Theory/ Practical	Internal Assessment Marks/ Theory/ Practical	Marks at the end of Exams	Total Marks
	Core Subject						
1	Bot.CT 2.1 Ecology and Environmental Biology	4	4	3	25	75	100
2	Bot. C T 2.2 Concepts in Biochemistry and Biophysics	4	4	3	25	75	100
3	Bot. CT2.3 Biotechnology, Computer applications and Biostatistics	4	4	3	25	75	100
	Elective						
4	Bot ET 2.4 Medicinal Plants	4	4	3	25	75	100
	Practicals						
5	Bot. CP2.1 Based on Bot. CT 2.1	2	4	4	10	40	50
6	Bot. CP2.2 Based on Bot. CT 2.2	2	4	4	10	40	50
7	Bot. CP 2.3 Based on Bot. CT 2.3	2	4	4	10	40	50
	Elective						
8	Bot. EP 2.4 Based on Bot ET2.4	2	4	4	10	40	50
	Total	24	32	28	140	460	600

M.Sc.-IIIrd Semester

Sl. No	Paper code no and Title	Credits	No of hrs/week /Theory/ Practical	Duration of Exam. In hrs Theory/ Practical	Internal Assessment Marks/ Theory/ Practical	Marks at the end of Exams	Total Marks
	Core Subject						
1	Bot. CT3.1 Plant Physiology	4	4	3	25	75	100
2	Bot. C T3.2 Cell Biology and Genetics	4	4	3	25	75	100
3	Bot. CT3.3 Developmental Biology of Plants and Tissue Culture	4	4	3	25	75	100
	Elective						
4	Bot. ET3.4 Plant Biotechnology	4	4	3	25	75	100
	Prcacticals						
5	Bot. CP3.1 Based on Bot. CT 3.1	2	4	4	10	40	50
6	Bot. CP3.2 Based on Bot. CT 3.2	2	4	4	10	40	50
7	Bot. CP 3.3 Based on Bot. CT 3.3	2	4	4	10	40	50
	Elective						
8	Bot. EP 3.4 Based on Bot. ET 3.4	2	4	4	10	40	50
	Total	24	32	28	140	460	600

M.Sc-IVth Semester

Sl.No	Paper code no and Title	Credits	No of hrs/week /Theory/ Practica	Duration of Exam. In hrs Theory/ Practical	Internal Assessment Marks/ Theory/ Practical	Marks at the end of Exams	Total Marks
	Core Subject						
1	Bot. CT4.1 Mycology and Plant Pathology	4	4	3	25	75	100
2	Bot. C T4.2 Plant Breeding and Plant Propagation	4	4	3	25	75	100
4.3.1	Bot. CT4.3.1 Plant Tissue Culture	4	4	3	25	75	100
4.3.2	Bot. CT 4.3.2 Reproductive Biology of Higher Plants	4	4	3	25	75	100
4.3.3	Bot. CT 4.3.3 Applied Microbiology, Applied Mycology and Plant Pathology	4	4	3	25	75	100
4.3.4	Bot. CT 4.3.4 Phytdiversity and Environmental Biology	4	4	3	25	75	100
4	Bot. CT 4.4 Project	6	4	6 Dissertation evaluation 75 Marks	25	50 Marks Viva-Voce	150
	Prcacticals						
5	Bot. CP 4.1Based on Bot CT4.1	2	4	4	10	40	50
6	Bot. CP 4.2Based on Bot.CT4.2	2	4	4	10	40	50
7	Bot.CP 4.3.1/4.3.2/ 4.3.3/4.3.4 Based on Bot.CT4.3.1/4.3.2/ 4.3.3/4.3.4	2	4	4	10	40	50
	Total	24	32	28	140	460	600

M.Sc BOTANY

FIRST SEMESTER

Theory papers:

Bot.Core Theory

1.1 Microbiology and phycology

Bot.Core Theory

1.2 Systematic Botany of Angiosperms

Bot.Core Theory

1.3 Evolutionary Biology, Economic Botany and Plant
Geography

Elective Theory

1.4 Biodiversity

SECOND SEMESTER

Theory papers:

Bot.Core Theory

2.1 Ecology and Environmental Biology

Bot.Core Theory

2.2 Concepts in Biochemistry and Biophysics

Bot.Core Theory

2.3 Biotechnology, Computer applications and Biostatistics

Elective Theory

2.4 Medicinal Plants

THIRD SEMESTER

Theory papers:

Bot.Core Theory	3.1 Plant Physiology
Bot.Core Theory	3.2 Cell Biology and Genetics
Bot.Core Theory	3.3 Developmental Biology of Plants and Tissue Culture
Elective Theory	3.4 Plant Biotechnology

FOURTH SEMESTER

Theory papers:

Bot.Core Theory	4.1 Mycology and Plant Pathology
Bot.Core Theory	4.2 Plant Breeding and Plant Propagation
Bot.Core Theory	4.3 Special Papers (Allocated on the basis of choice cum merit basis)
	4.3.1 Plant Tissue Culture
	4.3.2 Reproductive Biology of Higher Plants
	4.3.3 Applied Microbiology, Applied Mycology and Plant Pathology
	4.3.4 Phytodiversity and Environmental Biology
Project	4.4

SEMESTER - I

Bot.CT-1.1 : MICROBIOLOGY AND PHYCOLOGY

MICROBIOLOGY:

- Unit 1.** Diversity in structure and organization and life cycles other than Eubacteria:
Mycoplasmas, Spirochaetes, Rickettsias, Archaeobacteria, Methanogens, Halobacteria,
Cyanobacteria, Plant Viruses and Prions. 4hrs
- Unit 2.** Fungi: Introduction, general features, classifications and Reproduction. 3hrs
- Unit 3.** Microorganisms in the ecosystem: Psychrophilic, Mesophilic, Acidophilic and Thermophilic microorganisms. Distribution of microorganisms in fresh and marine water and their useful and harmful role. Distribution of microorganisms in Soil and its role in Soil formation, Soil fertility, Symbiotic and Non- Symbiotic nitrogen fixation of VAM fungi, Biopesticides and Silage. Microbiology of **Air**: Algae, Fungi, Bacteria and Lichens, Pollen grains and others, Aeroallergens and Aeroallergy. 5hrs
- Unit 4.** Microbial genetics: Recombination, transformation, conjugation, transduction and parasexuality. bacteriophage, lytic and lysogenic cycles. 5 hrs
- Unit 5.** Role of Microbes in Metabolic pathways, Photosynthetic pigments in Bacteria- Oxygenic and Anoxygenic photosynthesis. Anabolic process (biosynthetic) pathways, catabolic (degradative) pathways, Microbial degradation of Cellulose, Lignin, Starch, Fermentation pathways, Homolactic acid fermentation pathway. 4hrs
- Unit 6.** Immunology: Introduction, physical and mechanical factors, Biochemical factors, Genetic factors, Cellular factors, Active immunity (Natural- Artificial), Passive immunity (Natural- Artificial). Precipitin test, inflammation and interferon. Scope of Immunology: Application in medicine, Application in treatment of diseases, Application in blood grouping, Application in organ transplantation and tissue grafting. 5hrs

REFERENCES

1. R.C.Dubey and Maheshwari.D.K.2002. A Text book of Microbiology, S.C.Chand and Company, Ltd. Ramnagar, New Delhi.
2. S.B.Sullia and Shantharam. S.1998. General Microbiology. Oxford and IBH publishing Co.Pvt.Ltd. New Delhi.
3. Sharma. P.D.1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India.
4. Ananthnarayan, R and Jayaram Panikar,C.K. 1986. Text book of Microbiology. Orient Longman ltd. New Delhi.

5. Allas, R.M. Microbiology: Fundamentals and Applications, Macmillan publishing co. New York.
6. Brook, T.D. Smith, D.W and Madigan, M.T. 1984. Biology of Microorganisms, 4th ed. Eaglewood Cliffts. N.J.Prentice- Hall. New Delhi.
7. Claus, William, G.1989. Understanding microbes. A laboratory text book for Microbiology. W.H.Freeman and Company. New York.
8. Jayaraman, J. 1985. Laboratory Manual of Biochemistry, Wiley Eastern Limited. New Delhi.
9. Ketchum, P.A. 1988. Microbiology, concepts and applications. John Wiley and Sons. New York.
10. Stainer, Roger, Y. Ingrahan, John, L. Wheelis, Mark,L and Painter, Page,R. 1990. Microbial World 5th edition. Prentice-Hall India, Pvt.Ltd. New Delhi.
11. Schlegel, H.G.1986. General Microbiology. Cambridge University Press. London, 587pp.
12. Sharma, R.2006. Text book of Microbiology. Mittal Publications. New Delhi. 305pp.
13. Reddy, S and Ram *et al.* 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp.

PHYCOLOGY:

Unit 1. Basic characters of Algae:

- a. Origin of algae
- b. Pigments in algae and classification 3 hrs.

Unit 2. The prokaryotic algae:

- a. Structure and composition of prokaryotic algal cell
- b. Distribution and morphology of prokaryotic algae
- c. Reproduction in prokaryotic algae
- d. Nitrogen fixation and economics of prokaryotic algae. 5 hrs.

Unit 3. The Eukaryotic Algae:

- a. Structure and composition of eucaryotic algal cell
- b. Range of thallus construction in eucaryotic algae
- c. Mode of reproduction in eucaryotic algae 4 hrs.

Unit 4. Algae and water Pollution:

- a. Phytoplankton and their classification
- b. Algae as indicators of water quality
- c. Algal blooms- causes and effect
- d. Algae in water supplies and their control. 4 hrs.

Unit 5. Ecology of marine algae:

- a. Distribution of marine algae
- b. Factors controlling growth and distribution 2 hrs.

Unit 6. Cultivation of algae:

- a. Mass cultivation of microalgae

b. Cultivation of –i) *Porphyra*: Structure, reproduction and protocol for cultivation of *Porphyra* ii) Agarophytes: Requirements, methodology, harvesting and processing of agarophytes. 5 hrs.

Unit 7. Biochemicals from algae:

Pigments, enzymes, vitamins, antibiotics, essential fatty acids, polysaccharides, hydrocarbons, plant growth regulators, osmoregulators, biosurfactants, sterols, bioflocculants, aminoacids and liposomes. 2 hrs.

REFERENCES:

- Fatma, T. 1999. Cyanobacterial and algal metabolism and environmental biotechnology. Narosa Pub. House, New Delhi.
- Kamat, N.D. 1982. Topics in Algae. Saikripa Prakashan, Aurangabad.
- Palmer, C.M. 1980. Algae and Water pollution. CHP Pub.
- Prescott, G.W. 1984. The Algae: A Review.
- Robert Edward Lee 1995. Phycology. Cambridge Univ. Press.
- Venkataraman, L.V. and E.W. Becker, 1985. Biotechnology and utilization of algae. The Indian experience. DST, New Delhi
- Verma B.N., A.N.Kargupta and S.K. Goyal 1998. Advances in Phycology. APC Pub. New Delhi

Bot.CP-1.1: PRACTICALS (Based on Bot.CT1.1)

MICROBIOLOGY:

1. Safety measures in microbiology laboratory.
2. Study of instruments: Hot air oven, Autoclave, Inoculation needles, petriplates, incubator, ultraviolet lamp, laminar flow hood.
3. Preparation of Culture media: PDA, CZA, Nutrient media, preparation of agar slants, method of inoculum transfer (pouring techniques).
4. Serial dilution technique.
5. Staining of Bacteria, Simple, Positive and Negative staining.
6. Microbial Examination by Petriplate expose method.
7. Rotrod sampler, leavening of Bread Yeast/ Fermentation of Yeast.
8. Observation of VAM fungi by root maceration technique.

PHYCOLOGY:

1. Thallus in prokaryotic algae
2. Thallus in eucaryotic algae
3. Phytoplankton and indicator algae
4. Marine algae
5. Enrichment culture of algae and enumeration
6. Separation of algal pigment.

Bot.CT-1.2 : SYSTEMATIC BOTANY OF ANGIOSPERMS

Unit 1. Scope of systematic botany:

Aims and objectives, Floras, Monographs, Floral diagram, Floral formulas. 1 hr

Unit 2. Development and phases of classification:

Pioneer phase, consolidation phase, Biosystematic phase, Alpha taxonomy, Beta taxonomy, Gamma taxonomy, Omega taxonomy, Serotaxonomy, Holotaxonomy. Horizontal classification and vertical classifications. 2 hrs

Unit 3. Systems of classifications:

General classification of plant kingdom based on evolution.

Artificial classification- Linneous

Natural classification- Bentham and Hooker

Phylogenetic classification-

a. Transitional phylogenetic system- Engler and Prantl

b. Intentional phylogenetic system- Charles Bessey and John Hutchinson

c. Contemporary phylogenetic system-Taktajhan, Robert Thorne, Cronquist, Dahllgren, Angiosperm phylogeny group (APG). 10 hrs

Unit. 4. Taxonomic ranks and Numerical taxonomy:

Concept of family, genus, species, intraspecific clones, Numerical taxonomy, aims and objectives. Advantages of Phenogram, cladogram, and dendrogram. 5 hrs

Unit. 5. Taxonomic evidences:

Anatomical, Embryological, Palynological, Chromosomal, Phytochemical and Molecular. 10 hrs

Unit. 6. Plant nomenclature:

Vernacular names and botanical names

Principles of ICBN. Principles of priority

Names of genus species, Hybrids, Type method author citation publication of names, nomina conservanda, names nova, names of cultivated plants, rejection of names effective and valid publications. Unified biological nomenclature biocode and phylocode 4 hrs

Unit 7 Botanical Gardens and herbaria

Nature and importance of Botanical garden in plants conservation, BSI and its role in plants conservation Herbarium collection and preparation of herbarium specimen and preservation method significance herbarium. 4 hrs

Unit 8 Salient features and systematic relationships of following families

Dicot Families:

a. polypetalous families:

Ranunculaceae, Magnoliaceae, Capparaceae, Caryophyllaceae, Malvaceae, Tiliaceae, Sterculiaceae, Rhamnaceae, Sapindaceae, Rosaceae, Fabaceae

b. Gamopetalous families:

Apocynaceae, Bignoniaceae, Solanaceae, Scrophulariaceae.

c. Monochlamydous families:

Chenopodiaceae, Aizoaceae, Polygonaceae, Nyctaginaceae, Piperaceae, Lauraceae, Santalaceae, Loranthaceae, Urticaceae, Ulmaceae, Moraceae, Cannabinaceae.

Monocot families

Pontederiaceae, Hydrocharitaceae, Amaryllidaceae, Commelinaceae, Arecaceae and Cyperaceae. 14 hrs

REFERENCES:

1. Introduction to principles of plant taxonomy. By V. V. Sivarajan. C.U.P New York 1991.
2. Flowering plant- taxonomy and phylogeny. By B. Bhattacharya and BM Johri, Narasa Publishing House, New Delhi.1996
3. Current concepts in plant taxonomy. By V.H. Heywood and DN Moore, Academic Press London.1994
4. Taxonomy of Angisperms. By V.N. Naik. Tata Mb-Graw-Hill Publishing Company Ltd., New Delhi.1993
5. Experimental plant taxonomy. By S.K. Sachdeva and C.P. Malik. Kalyani publishers New Delhi.1986
6. Taxonomy of vascular plants. By G.H.M. Lawrence. Mac Millan, New York. 1959
7. Principles of numerical taxonomy. By Sokal R.R. and Sneath P.H.A. W.H. Freeman, San Francisco.1963
8. Taxonomy, Phytogeography and evolution. By D.H. Valetni (ED) Academic press London
9. Plant geography.. By Martin C. Lant.
10. Introduction to plant geography. By Polunin
11. Taxonomy of Angisperms. By V.N. Naik.
12. Systematic Botany of Angiosperm. By R.K. Datta.
13. Plant taxonomy. By O.P. Sharma
14. Taxonomy of flowering plants. By Bhatacharya.

CP-1.2 : PRACTICALS (Based on CT 1.2)

- 1) Description of specimen from locally available families
- 2) Location of key characters and use of keys at family, genus and species level.
- 3) Field trips within and around the campus.
- 4) Training in using floras and herbaria for identification of specimen describing in the class.
- 5) Study of pollen grains useful in plant taxonomy
- 6) Preparation of herbarium sheets of wild and cultivated plants.
- 7) Preparation of key for available taxa.
- 8) Calculation of similarity coefficient and preparation of dendogram of different taxa.

Bot. CT.1.3 : EVOLUTIONARY BIOLOGY, ECONOMIC BOTANY AND PLANT GEOGRAPHY

EVOLUTIONARY BIOLOGY:

Unit 1. Origin of life:

Abiogenesis, hypothesis of panspermia. Theory of chemical evolution .origin of life at molecular level. Miller experiment, protenoids, microsphere, RNA first model. 5 hrs

Unit 2. Process of origin of life:

Structure of cosmos, primitive earth, prebiotic synthesis, evolution of progeno. origin and evolution of RNA world, ribonucleoproteins, adoptive radiation in progenote. evolution of eukaryotes : a. endosymbiotic hypothesis, invagination of surface membrane, molecular evolution, evolution of proteins, insulin, haemoglobin, cytochrom c and neutral theory of protein evolution. 5 hrs

Unit 3. Theories of Evolution:

Lamarckism Neolamarckism, Darwinism, Neodarwinism, Germplasm theory, Mutation theory and Synthetic theory. 5 hrs

Unit 4. Population genetics and evolution:

Mendelian population, Gene pool, gene frequency, genetic drift, founder effect, genetic polymorphism. Hardyweinbergh law: genetics equilibrium and mechanism of speciation.

Unit 5. Pattern of evolution in plants:

Evolution of vegetative, reproductive structures in Algae, fungi, bryophytes, pteridophytes and spermatophytes.(Evolution of sporophyte in bryophytes).Stelar evolution in pteridophytes, heterospory and seed habit. Fossil forms- lepidodendron, lepidocarpon, stigaria etc 5 hrs

ECONOMIC BOTANY:

Unit 6. Cultivation and economic uses of food plants, drug plants, food adjuncts, timber plants, rubber plants, beverage plant ,oil plants, sugar cellulose and starch plants. 10 hrs

Unit 7. Plants as renewable source of energy. 01 hr

Unit 8. Conservation of economically important plant genetic resources. 01 hr

PLANT GEOGRAGHY:

Unit 9. Principles of plants Geography. 02 hrs

Unit 10. Origin of Islands and continents:

Pangea, panthalasa, Laurasia, gondwana land, plate tectonics and continental drift. 02hrs

Unit 11. Centers of origin of Cultivated plants:

Vavilov centers and zhukosky centers with plants in each region. 03 hrs

Unit 12. Geography and plant distribution:

Floristic region of world, phytogeographical region of India, Hansesen's classification Distribution of plants based on altitude and latitude. 04hrs

Unit 13. Plant distribution and plant migration:

contism, dricontinism and endemic distribution. Age and area hypothesis, wills theroy, vicaridess and theroy of tolerance. Plant migration and barrier for plant migration. 03 hrs

REFERENCES :

1. Evolution , By Strickberger, M.W.
2. Genes and Evolution, By Jha, A.P. 1993.
3. Organic evolution. By Lull, R.C 1976.
4. Organic evolution. By Arumugam N. 1992.
5. Diversity and Evolutionary biology of tropical flowers, By Endress, P.K. 1994.
6. The Geography o flowering plants . By Ronald Good, Longman, London 1974.
7. An introduction to plant ecology, Phytogeography, economical Botany to paleobotany. A.K. Ganugly and N.C. Kumar. Emkay Publications. New Delhi.
8. Economic Botany : A text book of useful plants and plant products. By Albert Hill. Tata McGraw Hill Publising company Ltd. New Delhi.
9. Economic Botany. By B.P. Pandey S.Chand and Company Ltd New, Delhi.
10. Economic Botany. By S.Sen. New central Book Academy Calcutta.
11. A text book of Economic Botany. By V.Verma. Emkay publication , New Delhi.
12. Dictionary of Economic plants in India. By Mahashwari. P.W Umraosingh. ICAR,N. Delhi.
13. A text book of Biotechnology. By R.C. Dubey. S.Chand and Company Ltd.New Delhi.

Bot.CP-1.3 : PRACTICALS (Based on Bot.CT 1.3)

1. Models to be shown (fossils can be demonstrated)
2. Demonstration of models/Explanation of models.
3. Explanation of Hardyweinbergh law with some genetic problems.
4. Steles in Pteridophytes.
5. Sprophytes of Bryophytes.
6. Photographs of Evolutionary biologists.

Bot.ET-1.4 : (ELECTIVE) BIODIVERSITY

Unit 1. Definition and concept of Biodiversity, scope and constraints of Biodiversity. 2 hrs.

Unit 2. Levels of Biodiversity:

- a. Genetic diversity
 - b. Species diversity
 - c. Ecosystem diversity
- 8 hrs.

Unit 3. Magnitude of Biodiversity:

- a Magnitude of global biodiversity
 - b. Phytodiversity in India
 - c. Faunal diversity in India
- 3 hrs.

Unit 4. Magnitude and status of Biodiversity in Karnataka:

- a. Terrestrial mammals of Karnataka
- b. Reptiles and amphibians of Karnataka

c. Bird fauna of Karnataka	
d. Phytodiversity of Karnataka	6 hrs.
Unit 5. Concept of Hot Spots:	
a. Endemism	
b. RET species	
c. Definition of hot spots and hot spots in India.	6 hrs.
Unit 6. Loss of Biodiversity:	
a. Loss of genetic diversity	
b. Loss of species diversity	
c. Loss of ecosystem diversity	8 hrs.
Unit 7. Conservation of Biodiversity:	
a. <i>In situ</i> conservation of Biodiversity	
b. <i>Ex-situ</i> conservation of Biodiversity	8 hrs.
Unit 8. Biodiversity prospecting:	
Bioprospecting, Indigenous knowledge, Biopiracy, IPR.	4 hrs.
Unit 9. Rio de Janeiro Earth Summit:	
Biodiversity and Agenda 21.	3 hrs.
10. The biological Diversity Bill 2000	2 hrs.

REFERENCES:

- Anonymous 1999 & 2004. State Forest Report. FSI, Dehra Dun.
- Anonymous 2000. Workshop on Karnataka Bio-diversity information system. Department of Forest, Ecology and environment and KSCST Bangalore.
- Haywood, V.H. and R.T.Watson 1995. Global Biodiversity Assessment UNEP Cambridge Univ. Press.
- Henry, R.J. (Ed.) 2005. Plant Diversity and Evolution. CABI Publishing, UK.
- Khan, M.A. and S. Farooq 2000. (Ed) Environment, biodiversity and conservation. A.P.H. Pub. Corporation, New Delhi.
- Krishnamurthy, K.V. 2004. An advanced textbook on Biodiversity Principles and Practice. Oxford and IBH Publishing Co. Pvt. Ltd.
- Lokeshwar Rao, M. 2004. Plant Biodiversity of World. International Book Distributors, Dehradun.
- Negi, S.S. 1993. Biodiversity and its conservation in India. Indus publishing company, New Delhi.
- Rao, R.R. 1994. Biodiversity in India (Floristic Aspects) Bishen Singh Mahendra Pal Singh, Dehradun.
- Shantaram. S. and J.F. Montgomery (Ed) 1999. Biotechnology, biosafety and biodiversity: Scientific and ethical issues for sustainable development. Oxford and IBH Pub. Co. PVT Ltd.
- Tetali, P. and S. Tetali. 2000. Endemic plants of India. Naoroji Godrej Centre for Pl. Res. Satara

Bot. ET-1.4 : PRACTICALS (Based on Bot. ET 1.4)

1. Population studies of microscopic organisms
2. Population studies of higher plants- Quadrat Method, Abundance, Basal Area, GBH, Frequency and Calculation of Species Diversity.
3. Estimation of tree profile, Canopy Cover and tree height.
4. Palynology in relation to phytodiversity.
5. Estimation of Biomass.
6. Estimation of Stomatal Index.
7. Estimation of quality of wood.
8. Bark studies in the identification of tree species.
9. Study of Mangroves- Morphology and Anatomy.
10. Aquatic vegetation and their adaptation.

SEMESTER- II

Bot.CT-2.1 : ECOLOGY AND ENVIRONMENTAL BIOLOGY

ECOLOGY:

Unit 1. Ecosystems:

Principles and concept of ecosystems- Components, production verses decomposition, Homeostasis (xenobiotics).

Principles and concept of energy in ecosystems- Energy and limiting factors, concepts of productivity, measurements of productivity, food chain, food webs and trophic levels

Diversity and characters of major ecosystems – Aquatic (Marine and Freshwater), Terrestrial and Agricultural ecosystems 10 hrs.

Unit 2. Biotic community and ecological niche-

A. Concept of biotic community:

Size and structure of biotic community- Physiognomy, Life-forms, stratification, ecotones and concept of edge-effect.

B. Ecological succession- causes and patterns of succession, concept of climax.

C. Concept of ecological niches, species coexistence, overlapping and niche segregation. 2 hrs.

Unit 3. Species Diversity-

A. Patterns of diversity in a community, Diversity measurement and indices.

B. Global distribution of organisms, concept of islands, biodiversity hotspots.

C. Conservation of biodiversity. 6 hrs.

Unit 4. Population biology:

Spacing and population density, Natality and mortality. Life table, population growth curves, carrying capacity. Regulation of population size, coevolution. 5 hrs

Unit 5. Interactions among organisms:

- A. Negative interactions. Inter specific competition, Predation, Parasitism and antibiosis.
- B. Positive interaction- Commensalism, co-operation and mutualism.
- C. Pollination Biology
- D. Herbivores and plant defense mechanism. 5 hrs.

Unit 6. Impact on Biodiversity:

Anthropogenic impact-

Eutrophication, Heavy metal pollution, Ozone depletion, greenhouse effect, Global warming and its effect, Acid rains. Pesticide, particulate and nuclear radiation. Solid wastes. Noise Pollution. Pest population and its biological control, invasive species and their effects on native species in aquatic and terrestrial ecosystems. 12 hrs.

REFERENCES :

- Odum, E.P. 1996. Fundamentals of Ecology, Saunders, Philadelphia. (First Indian Ed.)
- Chapman, J.L. and M.J. Reiss. 2000. Ecology Principles and Applications.
- Kormondy, E.J. 1996. Concepts of Ecology, Prentice Hall India, New Delhi.
- Agarwal S.b. and M. Agarwal 2000. Environmental Pollution and responses, CRC Press, London.

Bot. CP- 2.1 : PRACTICALS (Based on CT 2.1)

1. Study of vegetation by quadrat and line transect method. Determination of Importance Value Index (IVI).
2. Ecological Instruments: Thermometers, Anemometer, Altimeter, Barograph, Thermograph, Hair Hygrograph, Psychrometer, Rain Guage.
3. Analysis of Water Sample: pH, Conductivity, Dissolved Oxygen, Carbonates and Bicarbonates, Chlorides, Free Carbon Dioxide, Hardness, Organic Matter.
4. Analysis of Soil samples: pH, Conductivity, Organic carbon, Moisture Equivalent, Capillary Power of soil, Percolation through soil, Saturation Capacity.
5. Estimation of Dust deposit on leaves.
6. Noise level measurements in different environment.
7. Measurement of productivity by light and dark bottle method.
8. Phytoplankton of freshwater habitats.

Bot.CT- 2.2 : CONCEPTS IN BIOCHEMISTRY AND BIOPHYSICS

BIOCHEMISTRY:

- Unit 1** Physical and chemical properties of water. Acid base chemistry, buffers, chemical bonding and bond energy in bimolecules 4- hrs
- Unit 2** Nucleotides and nucleic acids: structures of nucleotides and poly nucleotides. Chemical and physical properties of nucleic acids. Chemical synthesis of poly nucleotides. 4- hrs
- Unit 3** Amino acids- classification, properties, peptide bonds. 4- hrs
- Unit 4** Protein – Structures, Sequence, Conformation. 3- hrs
- Unit 5** Carbohydrates – Monosaccharide and Disaccharides. Structures of starch, cellulose, pectin and chitin. 4- hrs
- Unit 6** Lipids – classification and Chemical structures and physical properties of saturated and un saturated fatty acids. 4- hrs
- Unit 7** Enzymes – Nature and classification of enzymes. Enzymes kinetics, bisubstrate reaction. 5- hrs

BIOPHYSICS:

- Unit 1** Atoms, bonds and molecules, basic Principle of diffusion, Osmosis and viscosity and their application in biology. 3- hrs
- Unit 2** Electromagnetic radiation – spectrum and light scattering, adsorption and emission of electromagnetic radiation by bimolecules. 4- hrs
- Unit 3** Fluorescence and phosphorescence of biomolecules – Theory of fluorescence, fluorescence detection. Spectroscopy applied to protein, nucleic acid and membranes. 5- hrs
- Unit 4** Nuclear magnetic resonance – Solid state NMR, magnetic resonance imaging, application of NMR in the study of protein, nucleic acid membranes and metabolism. 5- hrs
- Unit 5** Mass Spectrometry – Basic theory and instrumentation; Infrared spectroscopy basic theory and instrumentation. Laser - Knowledge of lasers, application in biology and Medicine . 5- hrs

REFERENCES:

- Lehninger Principles of Biochemistry DL Nelson and MM Cox, Mac Millan Worth publisher, 2000.
- Fundamentals of Biochemistry. D. Vote, J.G. Vote, and C.W. Pratt, John Wiley an Sons 1999.
- Physical Biochemistry, K.E Van Holde, W.C. Johnson and P. Shing Ho, Prenta Hall International IN. 1998.
- Essential of Biophysics, P. Naryanan. New Agri International publisher, 2000.
- Modern Experimental Biochemistry, (3rd Edn.) R.Boyer, Benjamin Cumming, 2000.
- Practical Biochemistry, Principle and Technique (5th Edn.) K. Wilsen and J. Walker, Cambridge University press. 2000.

Bot. CP - 2.2: PRACTICALS (Based on Bot. CT 2.2)

1. Extraction of chloroplast pigments and demonstration of their absorption spectra.
2. Extraction of seed proteins.
3. Determination of iodine –fats and oils
4. Estimation of proteins- spectrophotometer.
5. Estimation of Phospholipids.
6. UV and Visible spectra of biomolecules.
7. Fractionation of proteins by gel filtration..
8. Interpretation of IR and NMR Spectra of small molecules.

Bot. CT- 2.3 : BIOTECHNOLOGY , COMPUTER APPLICATIONS AND BIOSTATISTICS

BIOTECHNOLOGY:

- Unit 1** Introduction, Aim and scope of Biotechnology. Extraction and purification of DNA from bacteria, Fungi and plants. Restriction digestion and electrophoretic separation. The restriction DNA fragments in physical maps. Southern, northern blotting and hybridization techniques. 6 hrs
- Unit 2** Methods of cloning: Use of DNA linkers and adaptors for cloning. Selection methods for recombinant vectors. Methods for clone identification. Studying the location of cloned gene. Identifying and studying of the translation product of cloned gene. 5 hrs
- Unit 3** Marker and reporter genes used in plant systems. Manipulation of gene expression in plants. Isolation and uses of different promoters. 2 hrs
- Unit 4** Agrobacterium mediated gene transfer. Ti plasmid derived vector systems structure and restriction sites. The mechanism of T-DNA transfer from Agrobacterium to plant cells. Bt-toxin gene transfer to plants. And Transgenic expression. 2 hrs
- Unit 5** Engineering herbicide resistant, insect resistant, disease resistant (Viral, bacterial, fungal) and stress (abiotic) tolerant plants. 6hrs
- Unit 6** Antisense strategies for genetic manipulation in plants. Development of antisense technology for commercial purpose with special reference to fruit ripening and delay of senescence in flowering. 2hrs
- Unit 7** Production of vaccines, antigens and antibodies from plants. 1hrs
- Unit 8** Biotechnological application with reference to alkaloid biosynthesis. 1hrs
- Unit 9** Fuel biotechnology: Bio-diesel from lipids and other hydrocarbons. Desirable and undesirable features of biofuels. 1hrs
- Unit 10** Environmental applications of plant biotechnology and Phytoremediation. 1hrs

REFERENCES:

1. Brown, T.A. 1994. Gene cloning, Chapman and Hall publication. London.
2. Narayan, L.M. Moni, A., Selvaraj, A.M. and Padmalatha Singh. 1998. Molecular biology and Genetic engineering saras publication. Nagercoil. Kanya kumar.
3. Trehan, K. 1991. Biotechnology Wiley Eastern Ltd.
4. Papadiwal P.B 1985. Biotechnology. Aurangabad.
5. Satagura Prasad, M.G. 2000. A text book of molecular biology and Biotechnology.
6. Keshav trehan. 1990. Cell Biotechnology. Wiley Eastern Ltd. New Delhi.
7. Walkar John. M. and Gustr. 1989. Techniques in Molecular Biology. 2 editions. Croon Helus.

COMPUTER APPLICATIONS:

- Unit 1** Knowledge of computer systems, hardware and software, CPU and other peripheral devices, software packages and programming language, scientific application packages. 3 hrs
- Unit 2** Awareness of Windows, documentation data analysis and presentation techniques using Windows programme. 2 hrs
- Unit 3** Computer and internet – The world wide web and local area network, information retrieval, communication using internet. Web data base directories, search engines, life science data bases, tools online and bioinformatics. 5 hrs

BIOSTATISTICS:

- Unit 1** Principle and practice of statistical methods in biological research. 2 hrs
- Unit 2** Basic statistics measures of dispersion Measures of central tendencies (Mean, Median, Mode) Frequency of distribution, Standard deviation coefficient of variation and standard error. 4 hrs
- Unit 3** Concept of probability – Probability distribution, binomial, poisson and normal distribution, the Chi-Square distribution. 4 hrs
- Unit 4** Tests of statistical significance – Hypothesis testing for a single population mean, difference between two population means, paired comparison. 5 hrs
- Unit 5** Regression and correlation – scatter diagram, simple linear regression and non-linear regression, correlation and correlation coefficient and application. One way analysis of variance, two – way analysis of variance and multivariate analysis of variance. 5 hrs

REFERENCES:

- Balaam LN, Fundamental of Biometry, George Allen and Unwin Ltd. London, 1972.
- Bliss CI, Statistic in Biology Vol. I and II, McGraw-Hill Inc. USA, 1970.
- Causton DR, A Biologist Mathematics, Edward Arnold (Publishers) Limited, London, 1977.
- Daniel WW, Biostatistics, 6th edition, John Wiley and Sons, New York, 1995.
- Daniel WW, Biostatistics, 7th edition, John Wiley and Sons, New York, 1995.
- Minieka E and Kurzeja ZD, Statistics for business with computer application, South Western College publishers, Australia, 2001.

Bot. CP- 2.3: PRACTICALS: (Based on CT 2.3)

BIOTECHNOLOGY:

1. Isolation and estimation of DNA
2. Isolation and estimation of RNA
3. SDS polyacrylamide gel electrophoreses of seed proteins.
4. Immobilization of cells and enzymes
5. Chromatographic purification of RNA fragments
6. Demonstration of agarose gel electrophoresis of DNA fragments.
7. Growth characteristics of E.coli using plating and Turbido metric method.

COMPUTER APPLICATIONS AND BIOSTATISTICS

1. Determination of mean, median, mode, standard deviation and standard error from the given set of data.
2. Linear aggression analysis, Analysis of variance.
3. Use of statistical packages for data analysis.
4. Data documentation analysis of windows.
5. Information retrieval and communication using internet.
6. Web data base directories and tools for biological science.

Bot. ET- 2.4: (ELECTIVE) MEDICINAL PLANTS

Unit 1. Introduction to the Medicinal Plants:

Classification of drugs-

- a. Drugs from underground parts
 - b. Drugs from Bark
 - c. Drugs from stems & woods
 - d. Drugs from Leaves
 - e. Drugs from Flowers
 - f. Drugs from Fruits & seeds
 - g. Drugs from Lower plants
- 6 hrs.

Unit 2 . Milestones in the study of medicinal plants in India:

- a. Hortus Malabaricus
 - b. Indian Medicinal Plants
 - c. Indian Meteria Medica
 - d. Poisonous plants of India
 - e. Dictionary of folk medicines in India
- 8 hrs.

Unit 3. Botany of medicinal plants:

- a. Ethnomedicobotany and its scope
 - b. Collection, identification and preservation of medicinal plants
- 5 hrs.

Unit 4. Systems of medicines:

- a. Evolution of systems of medicines
- b. Ayurveda system of medicine
- c. Sidda system of medicine

d. Unani system of medicine	
e. Chinese system of medicine	
f. Tibetan system of medicine	
g. The Naturopathy and Aromatherapy	
h. The Homoeopathy	5 hrs.
Unit 5. Indian Medicinal Plants Scenario:	
a. Status and prospects of medicinal plants in India and Karnataka	
b. Stress on medicinal plants	
c. Conservation of medicinal plants	8 hrs.
Unit 6. Medicinal plants and biotechnology:	
a. Outlines of cell and Tissue culture of medicinal plants.	
b. Outlines of bioreactors and hairy root culture	6 hrs.
Unit 7. Therapeutic properties of medicinal plants	
a. Plants with antimicrobial properties	
b. Lectins and their applications	
c. Saponins and their applications.	6 hrs.
Unit 8. Formulations of Traditional medicines:	
a. Arishta and Asava	
b. Arka	
c. Avaleha and Paka	
d. Ghruta	
e. Churna	
f. Satva	3 hrs.
Unit 9. Cultivation of important medicinal plants.	3 hrs.

REFERENCES:

- Anonymous 1978. The Ayurvedic Formulary of India. Govt. of India Pub.
- Farooqi, A.A., Khan, M.M. and Vasundhara, M. 1999. Production technology of medicinal and aromatic crops. Natural Remedies Pvt. Ltd., Bangalore.
- Jain. S.K. 1991. Dictionary of Indian folk medicine and ethnobotany. Deep publications, Paschim Vihar, New Delhi.
- Kameshwara Rao, C. 2000. Material for the Database of Medicinal Plants. Karnataka State Council for Science and Technology for the Department of Forests, Environment and Ecology, Govt. of Karnataka Pub.
- Kirtikar, K.R. and Basu B.D. 2001 (Repr.) Indian Medicinal Plants. Oriental Enterprises Uttaranchal.
- Manilal, K.S. 2001. Van Rheede's Hortus Malabaricus English Edition. Univ. of Kerala Pub.
- Nadkarni, K.M. 1976 (Revised Ed.) Indian Materia Medica. Popular Prakashan, Bombay.
- Sharma, O.P. 1996. Hill's Economic Botany. Tata McGraw Hill Pub. New Delhi.
- Yoganarasimhan, S.N. 1996. *Medicinal plants of India. Vol. I. Karnataka.* Interline pub. Pvt. Ltd. Bangalore.

Bot. EP-2.4 :PRACTICALS (Based on Bot. ET 2.4)

1. Identification of medicinal plants including herbarium preparation
2. Study of Drug parts- Morphology and Anatomy
3. Phytochemical analysis (Pharmacognostic studies):
 1. Crude extract of drug by soxhlet extractor
 2. Test for phytochemicals- depending on available chemicals.
4. Preparation of drugs as per traditional system of medicine.
5. Estimation of Biomass of medicinal plants.
6. Visit to a field to document medicinal plants.

SEMESTER- III:

Bot. CT-3.1 : PLANT PHYSIOLOGY

- Unit 1 Bioenergetics** – First and second law of thermodynamics. Relation between reduction potential and free energy change. 3-hrs
- Unit 2** Study of glycolysis and citric acid cycle metabolic regulation of glycolysis and citric acid cycle.. 3-hrs
- Unit 3** Oxidative phosphorylation and photophosphorylation. Electron transfer reaction in mitochondria, light absorption by chloroplast pigments. External manipulation of pH in isolated chloroplast and mitochondria and ADP phosphorylation. 10- hrs
- Unit 4 Nitrogen metabolism** – Uptake of nitrate and its reduction. Catalytic and genetic regulation of nitrate reductase. Symbiotic nitrogen fixation. 5-hrs
- Unit 5** Carbohydrate biosynthesis and inter conversion photosynthetic carbon reduction cycle and its regulation. C-4 pathways and photorespiration. Biosynthesis of sucrose, starch and cellulose. 4- hrs
- Unit 6 Lipid metabolism** – Fatty acid Biosynthesis and oxidation. Biosynthesis and catabolism of storage lipids. Biosynthesis and function of membrane lipids. 5- hrs
- Unit 7 Membrane transport** – Organization of transport at plasma membrane and tonoplast, pumps carriers and ion channels, P-type and V-type ATPases , ABC transporters, measurement of membranes potential and channel current. Regulation of membrane transport in guard cells. 8- hrs
- Unit 8 Plant growth regulators** :Mechanism of action of Auxins, gibberellins, cytokinins, ethylene, abscisic acid, jasmonic acid, triacotinol and salicylic acid. 10- hrs

REFERENCES:

- Fundamentals of Biochemistry. D. Vote, J.G. Vote, and C.W. Pratt, John Wiley an Sons 1999.
- Physical Biochemistry, K.E Van Holde, W.C. Johnson and P. Shing Ho, Prenta Hall International IN. 1998.

Essential of Biophysics, P. Naryanan. New Agri International publisher, 2000.
Plant Biochemistry, P.M dey and J.B. Harborne, Harcourt Asia Ltd. Academic press, 1997.
Signal and Signal transduction pathways in plants. K. Palme (Ed.) Kluwer Academic publishers 1994.
Annual review of Plant Physiology and Plant Molecular Biology.

Bot. CP- 3.1 : PRACTICALS (Based on CT 3.1)

1. Effect of time and enzyme concentration on the rate of enzyme action.
2. Effect of substrate concentration and pH on enzyme action.
3. Extraction of total lipids from plant tissue purification by column chromatography analysis by TLC
4. Determination of lipase activity in germinating seeds.
5. Determination of chlorophyll a/b ratio in C3 and C4 plants.
6. Crassulacean acid metabolism.
7. Estimation of proline from stressed plants.
8. Gibberellin induction of amylase activity in cereal grains.
9. Effect of light, K, Ca and some inhibitions and against stomatal opening.
10. Determination of Photosynthesis rates in C3 and C4 plants using IRGA.

Bot. CT- 3.2 : CELL BIOLOGY AND GENETICS

CELL BIOLOGY:

- Unit 1** Organization of prokaryotic and eukaryotic cell, plasma membrane – molecular organization, cell differentiation.
- Unit 2** Nucleus – microscopic and sub microscopic organization. Structure and function of nuclear membrane. Nucleolus- ultrastructure and role in ribosome synthesis. 5- hrs
- Unit 3** Eukaryotic Chromosome – chromatin, its chemical nature, macro molecular organization. Heterochromatin and its significance, special types of Chromosomes, polytene and lamp brush Chromosome. Sex Chromosome, Structural change in Chromosomes. Numerical changes in Chromosome. Euploidy, haploidy, polyploidy. 6- hrs
- Unit 4** Cytoskeleton – Microtubules, Cilia, flagella, structure and function of ER, Golgi complex, mitochondria, Chloroplast, lysosome and peroxisome. 4- hrs
- Unit 5** Mechanism of cell division Mitotic apparatus, cytokinesis, Chromosome movement, molecular mechanisms of regulating mitotic events, meiotic stages, chromosome pairing, Chiasma formation. Cell signaling, Signaling pathways in plants. Molecular biology of signaling. 6- hrs

REFERENCES:

Alberts, B. Bray, D. Lewis, J.Raff, M. Roberts, K. and Watson, J.D. 1994.
Molecular biology of the cell., 3rd Ed.
Garrett, R.H. and Gresham. C.M. 1995 : Molecular aspects of cell biology. Saunders publishers, New York.

Lodish, H. Berk, A., Zipursky, S.L. Matsudaira, P., Baltimore, D. Darnell, J. 2000. Molecular cell biology. Freeman W.H. and Co. New York.
 Cooper, G.M. 1997. The cell : A molecular approach. ASM press, USA .
 Karp, G. 2000: Cell and molecular Biology: concepts of experiments. John Wiley and sons Inc. New York.

GENETICS

Unit I. Classical Genetics:

- a. Mendelism: Rediscovery of Mendel principles. Reasons for Mendel, character selected by Mendel. genotype, phenotype, back cross and test cross.
- b. Multiple alleles: Self sterility in tobacco. Blood groups in man.
- c. Gene interaction: Complementary genes (Flower colour in sweet pea) Albinism in maize (lethal genes in plants)
- d. Multiple gene interaction: Colour of wheat kernal, corolla length in tobacco.
- e. Linkage in sweet pea (coupling and repulsion) T series of linkage: differential multiplication theory and chromosome theory of linkage and factors affecting linkage.
- f. Chromosome mapping in maize and drosophila.
- g. Sex determination in plants.
- i. Extra chromosomal inheritance (chloroplast, mitochondria and episome). 8 hrs

Unit II. Gene and gene concept:

Structure of plant gene, function of gene, mutation of gene: Transition and transversion: silent mutation, frameshift mutation, nonsense mutation and point mutation and role of mutation in evolution. Transposons, as elements, split genes, selfish genes.

Regulation of gene expression in prokaryotes:

Concept of operon model and mechanism of operon model (structural genes, promoter genes, regulator genes and operator genes)

Regulation of gene expression in eukaryotes:

Regulation, transcription, processing, translation, one gene and one enzyme hypothesis, one gene and one polypeptide hypothesis. 8 hrs

Unit III. Genetic engineering:

Gene cloning recombinant DNA and PCR, vectors: phasmids, cosmids, molecular sensors restriction endonucleases and molecular suturess ligases . gene theory, gene banks DNA chips, cloning of Nif genes, isolation and introduction of Nif gene. Genetically modified plants and food. 9 hrs

REFERENCES:

Tamarin, R.M. 2000 : Principles of Genetics,. 6th Ed. WMC. Brown Publ. Co. London.
 Watson, J.D., Hopkins, N.H., Robert, J.W., Steitz, J.A. and Weiner, A.M. 1987: Molecular Biology of gene. 4th Ed. Benjamin. Publ. Co. New York.
 Strickberger, M. W. 1995 : Genetics. 3rd Ed. Prentice Hall Inc. London.
 Goodenough, U. 1990 : Genetics 4th Ed. Holt Saunders. Tokyo.

Bot. CP-3.2 : PRACTICALS (Based on CT 3.2)

CELL BIOLOGY:

1. Stains and dehydration grades for cytological studies.
2. Squash and smear preparations of mitotic and meiotic Chromosome, preparation of permanent slides.
3. Determination of Chromosome number at mitotic metaphase and diakinesis/metaphase I of meiosis.
4. Calculation of Chiasma frequency.
5. Isolation and separation of sub cellular organelles.
6. Identification of B – Chromosome. Polytene Chromosome in chironomos and fruit fly.

GENETICS:

1. Culture techniques and handling of fruit flies.
2. Life cycle of *Drosophila melanogaster*.
3. Identification of male and female flies.
4. Observation of mutant flies.
5. Crossing experiments and simple mendelian inheritance in fruit flies.
6. Study of growth curve in *E. coli*.
7. Conjugation in *E. coli*.
8. Problems in Genetics.

Bot. CT-3.3 : DEVELOPEMENTAL BIOLOGY OF PLANTS AND TISSUE CULTURE

Unit 1. Polarity in plants:

- a. Acellular, (*Dictyostelium*)
- b. Unicellular, (*Acetabularia*, *Fucus* egg, *Equisetum* spore)
- c. Multicellular, (Root hair and stigma formation)
- d. Organ, (Dorsiventral leaf)
- e. Colonial, (*Volvox* colony). 07 hrs

Unit 2. Apical meristem:

Ultrastructure, Biochemical activities, Regeneration and denovo in culture, split and damage apices. Bud dormance, Gene expression in shoot apex and SAM mutants. Quiscent center, genetics of root development. 07 hrs

Unit 3. Leaf primordium:

Phyllotaxis, Mechanism of leaf primordium initiation. Experimental model of modification of positioning, Genetics of phyllotaxy, plastochorns. Transition of reproductive phase, Phase change and developmental switching at the apex. Vernalization and changes in biochemical activity. 07 hrs

Unit 4. Developmental patterns at the flowering apex.

ABC model, and specification of floral organs homeotic mutants, reversal of flowering, Molecular aspects of MADS box genes during, flower development. Modification of gene action by growth substances, Cellular differentiation between floral organs. Senescence- a general account. 06 hrs

Unit 5. Androgenesis and Gynogenesis:

Ultrastructural, Histochemical, Genetical and Functional aspects. Concept of male and female germ unit and their significance.

Unit 6. Pollination and Fertilization:

Structural, Functional aspects of pollen style stigma. Current view of double fertilization and development of endosperm and its function. 07 hrs

Unit 7. Cellular and biochemical aspects of embryogenesis:

Gene activity during zygotic embryogenesis. Structure and function of embryo suspensor. Photomorphogenesis, Photoreceptors. Structure and function. Photoresponses and molecular mechanism. 06 hrs

Unit 8. Plant tissue culture:

Laboratory organization, Nutrient media, Sterilization techniques, Micropropagation, Cell suspension culture, Haploid production, Protoplast isolation and fusion. Cryopreservation, Production of synthetic seeds. *In vitro* production of zygotes. 10 hrs

REFERENCES:

1. Embryology of Angiosperms (1984) Ed. B.M. Johri Springer-verlag Publications
2. Introduction to the Embryology and Angiosperms by P. Maheshwari (1950) Mc Graw Hill NY.
3. Recent advances in the Embryology of Angiosperms Ed. P. Maheshwari (1963). Intl. Soc. Plant morphol. Delhi
4. The embryology of angiosperms (2000) by Bhojwani S.S. and Bhatnagar S.A. . Vikas publications house New Delhi
5. Pollen biology and biotechnology (2003) by K.R. Shivanna, Oxford and IBH publishing house New Delhi
- 6 Fertilization in Angiosperms /seed plants (Molecular and Cytological) by Cristi.
7. Plant morphogenesis by Sinnott
8. Plant tissue culture by M.K. Razdhan

Bot. EP 3.3 PRACTICALS (BASED ON Bot. CT 3.3)

1. Development of Anther and ovule / Permanent slide preparation
2. Histochemical test of Anther and ovule at different stages of development
3. Preparation of Brewbaker or Kwakh medium for pollen germination
4. Hanging drop technique for pollen germination
5. Pollen acetolysis to study pollen exine ornamentation and aperture

6. Mounting of embryo and endosperms
7. Preparation of MS media for plant tissue culture
8. Inoculation of explants on a nutrient medium
9. Root apical and shoot apical meristem
10. Callus histology/cytology

Bot. ET-3.4 : PLANT BIOTECHNOLOGY :

Unit 1 Introduction: Definition Old and New Biotechnology. An interdisciplinary activity, Scoped and importance, commercial potential, Biotechnology centers in India. 3 hrs.

Unit 2 Biofertilizers: Introduction, Types, Blue green algae, Sea weeds, Azolla, Vesicular arbuscular mycorrhizal fungi and Rhizobium. 6 hrs

Unit 3 Industrial Biotechnology: Introduction, Industrial microbial products: Alcohol production (Beer), Antibiotics production (penicillin), production of Vitamins (Vitamin B₁₂), production of Single Cell Protein, Algal protein: (Spirulina) Fungal protein: (Mushroom) and economic aspects. 10 hrs

Unit 4 Plant Tissue Culture: Introduction. Importance of plant tissue culture, Basic requirements for tissue culture laboratory, composition of tissue culture medium. Culture of plant tissues, Regeneration of plants, Root culture, meristem culture, Anther culture, Pollen culture. Role of tissue culture technology in crop improvements. 10 hrs

Unit 5 Biofuels: Introduction, Production of biogas, Structure of biogas plant, Biochemistry of methane production, Biogas research in India, Uses of biogas. 5 hrs

Unit 6 Plant Biotechnology Introduction, Somatic hybrids and cybrids, cytoplasmic gene transfer, gene transfer, Advantage and Limitations. 4 hrs

Unit 7 Genetic Engineering: Introduction, Genetic Engineering of microorganisms, Vectors of gene cloning direct transformations, Microinjection, Nuclear transplantation, Isolation and cloning plasmid and Mitochondrial genes. Transgenic plants with nifgenes. Improvement of seed proteins, production of disease free and disease resistant plants. 12 hrs

REFERENCES:

1. Glazer, A.N and Nikaido. H. 1995. Microbial Biotechnology. W.H.Freeman And co. New York.
2. Glielk Barnard and Pasternak, Jack.J.1996. Molecular Biotechnology principles and application of recombinant DNA: Pavan publishers. New Delhi.
3. Kumar.H.C. 1992. Text book on Biotechnology. East west press. New York.
4. Walker.J.M and Gingold. W.B. 1989. Molecular Biology and Biotechnology. 2nd edition. Royal Society of chemistry, London.
5. Keshav Trehan.1990. Biotechnology. Wiley Eastern/td. New Delhi.
6. Gaurd.R.S. Gupta.G.D and Gukhade.S.B.2000. Practical Biotechnology: Nirali park ashan publishers. Pune.

7. Firm.R.K and Prave.P Biotechnology. 1988. Hanser Publisher publication. New York.
8. Dube.H.C.1991. Fungi and Biotechnology. Today's and tomorrow's Printer and Publishers. New Delhi.
9. Stanbury.P.F and Whitaker.A. 1985. Principles and Fermentation technology pergaman press. Oxford.
10. Wiseman.A.1987. Hand book of enzyme Biotechnology. Ellis Horwood Ltd. New York
11. Tejovathi.G, Vimala.Y and Rekha Bhadauria, 1996. A practical manual for plant Biotechnology. CBS publishers and distributors. New Delhi.
12. Narayanan. L.M., Selva Raj, A.M., Mani.A and Arumugam.N.1998. Molecular Biology and Genetic Engineering. Saras publication. Nagercoil. India.
13. Colin Ratledge and Bjorn Kristainsen.2004. Basic Biotechnology. Cambridge University press London.
14. Snyder.L. and Champness, W. 1997. Molecular Genetics of Bacteria. American Society for microbiology. Washington DC.
15. Asenjo, J.A.1990. Separation process in Biotechnology. Marcel Dakker, New York.

Bot. EP-3.4 : PRACTICALS (Based on ET 3.4)

PLANT BIOTECHNOLOGY

1. Basic laboratory principles and techniques
2. Equipments and instruments.
3. Culture media: Simple media, Synthetic media, Complex media, Semi defined media, Special media, Enriched media.
4. Culture of Mushroom.
5. Mass culture of Spirulina.
6. Plant tissue culture techniques.
7. Isolation of DNA from plant materials.
8. Production of Synthetic Seeds.
9. Preparation of Wines from Grapes.
10. Experiment to demonstrate biogas production.

SEMESTER- IV

Bot. CT-4.1 MYCOLOGY AND PLANT PATHOLOGY:

MYCOLOGY

Unit 1 Biological feature of fungi –

Structure, mobility, life cycle pattern in fungi, reproduction – Asexual and sexual.

10- hrs

Unit 2 Structure and types of soil. Biological population and its relation with mycoflora. Predation, parasitism and antagonism. Rhizosphere, Rhizoplane and non- Rhizosphere fungi. Ecosystem and fungal community.

8- hrs

Unit 3 Fungal physiology –

Nutrition of carbon nitrogen, mineral, vitamin and growth regulators. Metabolisms and biosynthesis of carbohydrates and non-carbohydrates and nitrogen. 4 hrs

Unit 4 Secondary metabolites and their role. Fungi as genetic organism for genetic study 4 hrs

PLANT PATHOLOGY

Unit 1 . The concept of disease in plants, classification of plant disease, attack of pathogens mechanical forces, chemical weapons, enzymes. Microbial toxins and growth regulators. 8 hrs

Unit 2. Plant defense mechanism against pathogens, genetics of plants disease epidemiology. 4 hrs

Unit 3. Management and control of plant disease. 3 hrs

Unit 4 Application of Biotechnology in relation to plant pathology. 4 hrs

Unit 5. Environmental factors that cause plant disease. 5 hrs

REFERENCES:

Burnett, JH (1983) fundamental of Mycology, William Clows and Sons, London .

Subramanian CV (1991) Hyphomycetes, ICAR, New Delhi.

Reynolds DR (1981) Ascomycetes systematics – The Luttrelian concept, Springer, Verlag, New York.

Stevens, RB (1981) mycology Guide book, University of Washington Press, Washington.

Ingold, CT (1971) fungal spores – their liberation and dispersal. Oxford Univ. Press, Oxford.

Dickinson, CW and Pugh GJF (1974) Biology of plant litter decomposition. Vol I And II, Academic press London.

Ainsworth and Sussman, AS (1965,1966,1968,1973) The fungi, An advanced Treatise, Vol I- IV, Academic press New York.

Agrios, GN (1995) plant pathology, IV Edn Academic press Inc. London New York.

Horsfall, JG and Cowling, EB (1977-80) Plant Disease, Vol – I to V Academic press New York.

Rangaswamy, D (1988) Disease of crop plants in India, Prentice Hall India, Ltd New Delhi.

Asada, Y, Bbushnell, NR Ouchi. S, and Vance, P (1982) Plant infection. The physiology and Biochemical basis, Springer Verlag, Berlin New York.

Kosuge, T and Nester, EN (1984) Plant microbe interaction – molecular and genetic perspectives, MacMillan, New York.

Bot. CP. 4.1 PRACTICALS (Based on CT 4.1)

MYCOLOGY

1. Vegetative organization in fungi.
2. Asexual reproduction in fungi.
3. Sexual reproduction in fungi.
4. Rhizosphere, Rhizoplane, phylloplane studies of fungi.
5. Fungal physiology – Growth and nutritional studies.

PLANT PATHOLOGY

1. Disease of cereal crops.
 - a) Blast disease of Rice.
 - b) Yellow smut of wheat.
 - c) Loose smut of wheat.
 - d) Downy mildew of sorghum.
 - e) Anthraenose of sorghum
2. Disease of plantation crops.
 - a) Downy mildew of grapes.
 - b) Leaf rust of coffee.
 - c) Tikka disease of ground nut.
 - d) Late blight of potato.
3. Others -
 - a) Bean mosaic disease.
 - b) Sandal spike.
 - c) Tobacco mosaic virus disease.
 - d) Citrus canker.
 - e) Grass root sugarcane
 - f) Root knot of mulberry.
4. Isolation and inculcation of plant pathogens.
5. Estimation of spore production of fungal pathogens of leaves using Haemocytometer method.

Air dispersal of plant pathogens – an investigation using rotord sampler.

Bot. CT-4.2: PLANT BREEDING AND PLANT PROPAGATION

PLANT BREEDING:

Unit 1. History and scope of plant breeding.

5 Hrs

Unit 2. Plant Genetic resources:

- a. Importance and urgency.
- b. Sources of germplasm
- c. Systematic evaluation and utilization

- d. Germplasm conservation
 - e. Global and National organization for crop improvement
 - f. Pattern of evolution in crop plants. 5 hrs
- Unit 3. Conventional breeding methods:**
- a. Reproduction, Genetic basis, Sexual and crosspollination, Apomixes, Genetics induction and significance in plant breeding.
 - b. Domestication, Plant introduction and acclimatization. Selection in self, cross pollinated and vegetative propagated plants.
 - c. Hybridization: In self and cross pollinated plants. Vegetative propagated plants.
 - d. Back cross: Technique and importance. 7 hrs.
- Unit 4. Heterosis breeding**
- a. Inbreeding depression
 - b. Homozygous and heterozygous balance
 - c. Genetic basis of heterosis
 - d. Heterosis and plant breeding 3 hrs.
- Unit 5. Difference between production breeding to disease resistance**
- a. Types of resistance – Vertifolia effect, epiphytosis, vertical and horizontal resistance
 - b. Genetics of post and parasite relation ship.
 - c. Genetics of insect resistance
 - d. Mechanism of drought resistance
 - e. Genetics of drought resistance
 - f. Breeding methods for disease insect and drought resistance 7 hrs.
- Unit 6. Distant hybridization**
- a. Introduction history
 - b. Barrier to the production of distant hybridization
 - c. Techniques for production of distant hybrids.
 - d. Sterility in distant hybrids.
 - e. Consequence of segregation in distant hybrids.
 - f. Importance of distant hybridization in crop improvement. 5 hrs.
- Unit 7. Quality seeds.**
- a. Classes.
 - b. Production
 - c. Maintenance
 - d. Development of seed industry
 - e. The Indian seed act. 4 hrs.

PLANT PROPAGATION:

- Unit 1. Principles and concepts of plant propagation.** 1 hrs
- Unit 2. Propagating structures :**
Green house , shade house , net house, mist propagation unit, containers for growing plants. 2 hrs
- Unit 3. Media for propagation –**
Treatment of soil and soil mixtures, Fertilizers and sanitation 2 hrs
- Unit 4. Plant nurseries –**
Types, sites for their establishment, design and management. 2 hrs
- Unit 5. Seed propagation –**
Seed selection, testing and storage; principles and techniques, advantages and limitations; process of seed germination, seed dormancy, treatment to overcome pathogens. Seed viability tests, seed testing and seed certification (seed patent law). Hardening of seedlings. 2 hrs
- Unit 6. Vegetative propagation –**
Advantage and limitations. Sources, selection and management of the vegetative propagation 4 hrs
- Unit 7. Clones- Breeding of asexually propagated plants**
Source production and viability and maintenance. Genetic variability. Techniques of propagation by cutting; types of cuttings, rooting media, factors influencing rooting, treating cuttings with growth regulators, leafy cuttings. 2 hrs
- Unit 8. Propagation by specialized vegetative structures ;**
Bulbs, tubers, corms, rhizomes, runners, suckers, 2 hrs
- Unit 10. Layering and its natural modifications:**
Types and procedures of layering; Factors affecting regeneration by layering. 2 hrs
- Unit 11. Techniques of grafting and budding :**
Objectives ,methods and limitations, stock-scion relationship; micro grafting and microbudding; graft incompatibility : tools and accessories required for cutting, grafting and budding. 2 hrs
- Unit 12. Propagation methods of some important plants :**
Fruits and nuts; medicinal and aromatic plants; vegetables, ornamentals; succulents and cacti , house plants. 2 hrs
- Unit 13. Hydroponics:**
A general account. 2 hrs

REFERECENS:

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Plant Breeding 2000. B.D. Singh. Kalyani Publ. New Delhi.
Evolution of crop plants 1986. N.W. Simmonds (Ed).Longmann Sci. Tech. Pub. England

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 Heterosis 1983. Edi. R. Frankel and Bet Dagan. Springer Verlag. Berlin.
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 Advanced methods in plant breeding and biotechnology 1991.Ed. D.R. Murray. C.A.B. Iontr. U.K.
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 Schwalz. M. 1975 : Guide to commercial hydroponics. Israel Univerisity, Jerusalem.
 Sharma, V.K. 1996 Plant Nurseries : Techniques, production and management. Indian Pub. New Delhi.
 Sadhu, M.K. 1989 : Plant propagation. New Age Pub. New Delhi.

Bot. CP-4.2 : PRACTICALS : (Based on Bot. CT 4.2)

1. Reproductive biology
 - a. Self, b. Cross pollinated plants, c. Vegetative reproduction
2. Hybridization : Emasculation, bagging and production of hybrids if possible apparent pollen fertility.
3. Origin, distribution and centers of diversity of crop plants: Wheat, Sorghum, Rice,Chilly, sugarcane, Cotton, Potato, Coffee, Sunflower and Ground nut.
4. Preparation of media- treatment of soil and soil mixtures.
5. Breaking of seed dormancy and growing seedlings after treating with hormones.
6. Propagate the bulbs(Lilium, tubers (Potato, Begonia), corms(Gladiolus), Rhizome(Canna) Sucker (Banana).
7. Different types of layering (Simple layering, Tit layering, serpentine layering, Air layering; stool layering).
8. Grafting experiments – Whip (or splice) grafting methods ; side grafting; bark grafting, T-budding; Inverted T- budding; chip budding.
9. Demonstrate the experiments on the propagation of succulents by cutting and cacti by grafting.

SPECIAL PAPERS:

Bot. CT-4.3.1. PLANT TISSUE CULTURE

TISSUE CULTURE:

Unit 1. Cellular totipotency –

Cytodifferentiation, organogenesis, factors affecting organogenic differentiation.2 hrs

Unit 2. Somatic embryogenesis –

Induction, development and maturation. Factors affecting somatic embryogenesis, applications of somatic embryogenesis and synthetic seeds. Molecular biology of somatic embryogenesis: induction, development, synchronizing somatic embryo development. Hormonal regulation of somatic embryogenesis. Late embryogenesis abundant (LEA) gene expression. Genes isolated from somatic embryos. Expression

of 'non embryonic' genes during somatic embryogenesis. Somatic embryo as a genetic system. 5 hrs

Unit 3. Haploid production –

Androgenesis, anther and microspore culture, factors influencing anther/microspore culture, gynogenesis, production of haploids by wide hybridization. Applications. 4hrs

Unit 4. Triploid production –

Methods and applications. 2 hrs

Unit 5. In vitro pollination and fertilization –

Methods, factors affecting seed setting after in vitro pollinations, application. 2 hrs

Unit 6. Zygotic embryo culture –

Techniques, culture requirements, applications. 2 hrs

Unit 7. Somaclonal and gametoclonal variations:

Origin of somaclonal variation, mechanism underlying genetic variations, assessment of somaclonal variations. Isolation of variants – disease resistant lines, herbicide resistant lines, stress tolerant lines, applications. 4 hrs

Unit 8. Protoplast isolation and culture –

Isolation, culture and regeneration of protoplasts. 4 hrs

Unit 9. Somatic hybridization and cybridization –

Protoplast fusion methods, selection of hybrids and cybrids, assessment hybridity. Molecular analysis of nuclear genes and organellar genes in the somatic hybrids/cybrids. Protoplasts as a tool in cell biology and biotechnology. 4 hrs

Unit 10. Production of disease free plants-methods of virus elimination, eradication of pathogens other than viruses. 2 hrs

Unit 11. Micro propagation:

Techniques, multiplication by axillary and apical shoots, multiplication by adventitious shoots, multiplication through callus cultures, factors influencing shoot multiplication and rooting. Acclimatization of plants transferred to soil. 4 hrs

Unit 12. Production of secondary metabolites –

Application of tissue culture for synthesis of useful compounds. Techniques of selecting cell lines for high yields of compounds of secondary metabolism. Mass cultivation of cells by bioreactors. Elicitor induced accumulation of products. 4 hrs

Unit 13. Germplasm conservation –

Methods of conservation, cryopreservation. 4 hrs

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- J. R. Reinert and Y. P. S. Bajaj. 1977. Applied and fundamental aspects of plant cell, tissue and organ culture. Springer-Verlag, Berlin.
- Y. P. S. Bajaj (Ed.) Biotechnology in agriculture and forestry. Various volumes published time to time. Springer-Verlag, Berlin.
- T. A. Thorpe. 1981. Plant tissue culture. Academic Press, New York.
- T. A. Thorpe (Ed.) 1995. Embryogenesis in plants. Kluwer Academic Publishers, Netherlands.
- S. K. Sen and K. L. Giles (Ed.) 1983. Plant cell culture in crop improvement. Plenum Press, New York.
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- S. S. Bhojwani. 1990. Plant tissue culture: Applications and limitations. Elsevier Publishers, Amsterdam.
- I. K. Vasil (Ed.) Cell culture and somatic cell genetics of plants. Various volumes. Academic Publishers, Orlando.
- R. A. Dixon and R. A. Gonzales (Ed.) 1994. Plant cell culture, a practical approach. Second Edition. Oxford University Press, Oxford.
- O. L. Gamborg and G. C. Phillips. 1995. Plant cell, tissue and organ culture, fundamental methods. Springer International student Edition.
- Molecular Biotechnology (2nd Edn.) B.R. Glick and J.J. Pasternak, ASM Press, Washington DC. 1998.
- Genes VII, B. Lewin, Oxford University, Press, 2000
- Gene cloning, T.A. Brown, Chapman and Hall Publ. 1994.

Bot. CP-4.3.1 PRACTICALS : (Based on Bot. CT 4.3.1)

PLANT TISSUE CULTURE

1. Micropropagation by proliferation of axillary bud.
2. Anther culture for haploid production.
3. Microspore culture for haploid production.
4. Protoplast isolation and culture.
5. Embryogenesis in cultured cells/tissues.
6. Preparation of synthetic seeds.
7. Extraction and quantification of secondary metabolites from callus.
8. PCR technique
9. Co-cultivation of leaf discs with Agrobacterium and study of GUS

Bot. CT-4.3.2 : REPRODUCTIVE BIOLOGY OF HIGHER PLANTS

- Unit 1. Introduction Reproductive biology** 1 hr
- Unit 2. Anther** – Composition and reorganization of cytoplasmic constituents in the meiocytes during meiosis; Pollen formation : Structure and composition of pollen. The concept and significance of Male Germ Unit ; Formation of Generative and male cells in the pollen- their isolation, biochemistry, physiology and cytoskeletal organization. Complexity and specificity of sporophytic and gametophytic gene expression during anther development. Anther tapetum- Structure, composition and function. Pollen wall biology- Composition and function. 10 hrs.
- Unit 3. Pollen tube :**
Growth, composition chemotropism and cytoskeletal organization. 04 hrs.
- Unit 4. Ovule :**
Composition and cytoplasmic reorganization in the megasporocyte during meiosis; Megagametophyte- Structure, Composition and role of its constituent cells. The concept and significance of Female Germ Unit. Cytoskeletal organization of the megagametophyte cells. Expression of sporophytic and gametophytic specific genes during ovule and female gametophyte formation. Mutants that affect the development of pistil, ovule and female gametophyte. 10 hrs.
- Unit 5. Pollination :**
Structure, composition and function of stigma and style. Composition and role of stigmatic exudate and stylar matrix; Pollen-pistil interaction, Fertilization- Current outlook of double and preferential fertilization and their significance. 05hrs.
- Unit 6. *In vitro* fertilization and development of artificial zygotes and embryo through micromanipulation of male and female gametes.**
- Unit 7. Male sterility-**
Causes, biochemical and molecular aspects of cytoplasmic male sterility. 05hrs.
- Unit 8. Sexual incompatibility-**
Physiological and Biochemical mechanism of sporophytic and gametophytic self-incompatibility. Barriers of incompatibility 05hrs.
- Unit 9. Embryogenesis-**
Role of cellular and biochemical components during embryogenesis. Embryo suspensor- Biochemical, Physiological and Functional aspects. Regulation of gene activity during embryogenesis. Embryo mutants- lethal mutants, apical-basal mutants, pattern mutants and radial axis mutants. 05hrs.
- Unit 10. Endosperm-**
Biochemistry, Physiology and function. 05 hrs.

Bot. CP-4.3.2: PRACTICALS (Based on Bot CT 4.3.2)

1. Preparation of thin sections to assess the cytoplasmic contents in the meiocytes during meiosis, tapetum and pollen, using carbohydrates, proteins and RNA test.
2. Preparation of thin sections of ovule to verify the chemical composition of female germ unit using carbohydrates, proteins and RNA tests.

3. Effect of Boron, calcium and volatile substances polluted gases on pollen germination and tube growth.
4. Experiment to know the chemotropic effects of calcium and /or pistillar tissues and pollen.
5. Composition of pollen tube and stigmatic papillae using cytochemical tests.
6. In vivo growth of pollen tube using appropriate stains.
7. Conduct the experiment on isolation of generative/male cells from the pollen using osmotic shock method (*Vicia faba*).
8. Isolate the embryo sac by using micromanipulation method.
9. Isolate the embryo suspensor and analyse the chemical composition in it by using cytochemical tests.
10. Microtome sections of ungerminated and germinated monocot/dicot plant embryos to show the chemical composition in the root apical meristem and shoot apical meristem.
11. Diagrammatic representation of different ovular mutants.
12. Diagrammatic representation to show the expression of different genes during the development of embryo in *Arabidopsis* or any other plant investigated.

Bot. CT-4.3.3: APPLIED MICROBIOLOGY, APPLIED MYCOLOGY AND PLANT PATHOLOGY

APPLIED MICROBIOLOGY:

Unit 1 Agricultural Microbiology : The rhizosphere, rhizosphere effect, Nitrogen fixation in the rhizosphere, growth promoting rhizobacteria, siderophores, mycorrhizae, Phosphate solubilizing bacteria and Actinorhizal symbiosis i.e.(Frankia induced nodulation).The new green revolution, gene exchange in bacteria, Agrobacterium mediated transfer of genes(Gene protection technology for plants) Anti body mediated resistance , Resistance due to inter feron related genes, Manipulation of host genes for plant protection. Risks and Benefits. 4 hrs

Unit 2 Industrial Microbiology: Fermenters : Fermentation process, types of fermentation , alcoholic fermentation (Beer and Wine) , Organic acid fermentation (Citric acid) antibiotics production : (Penicillin) Enzymes (amylase),Production of steroid hormones, vaccines and production of Methane. 4 hrs

Unit 3 Dairy Microbiology: Sources of microbial contamination of milk , Types of microorganisms in milk- bacteria, fungi and yeast. Microbial examination of milk. Lactic acid production. Fermented dairy products. Methods of preservation of milk and milk products, pasteurization and sterilization. 4 hrs

Unit 4 Environmental Microbiology : Bio remediation, bio remediation of hydrocarbons, bio remediation of heavy metals, bio remediation of xenobiotics, Microbial leaching ,Biomining , Bioleaching of copper , uranium and gold. Recovering of minerals from microorganisms, recovering of oil and single cell oil. 3 hrs

Unit 5 Water Microbiology: Types of water- Atmospheric water and Surface water, stored water and ground water, Microbial analysis of water, sanitary test for coliforms (presumptive test, confirmed test, completed test). IMViC test, purification of water sedimentation, filtration (slow sand filtration, rapid sand filtration) disinfection 3 hrs

Unit 6 Immunological Techniques: Serological tests, precipitation of VDRL test for syphilis, ABO blood typing, Enzyme –linked immunosorbent assay (ELISA). Hybridoma technology, Radio immunoassay, Monoclonal antibodies , man made antibodies, production of antisera, vaccines and common immunization. 4 hrs

APPLIED MYCOLOGY

Unit 1 Preservation and maintenance of cultures, Batch, synchronous, continuous, and phased culture and their applications. 6 hrs

Unit 2 Mushroom production technology – advancement in technology of Mushroom cultivation with reference to strain improvement, wild edible mushrooms, cultivated species in India and abroad. 6 hrs

Unit 3 Non-industrial fungal metabolites, phytoalexins, hormones, pigments, lichen products and mycotoxins. 6 hrs

Unit 4 Production pharmaceutical products, fungal enzymes and their industrial applications. Production of single cell protein and feed stuffs 6 hrs

PLANT PATHOLOGY:

Unit 1 Nature and concept of epidemiology of plant diseases. Inoculum production potential and distribution. 4 hrs

Unit 2 Mechanism of infection, effect of environment on multiplication of pathogen and outbreak of disease. 4 hrs

Unit 3 Defense mechanism systems in plants Biochemical and physiological changes in plants due to infection, Preventive measures – physical, chemical and biochemical methods. 6 hrs

Unit 4 Plant disease forecasting, post harvest pathology, forest pathology and plant Quarantine. 6hrs

Unit 5 Specific plant diseases – plant diseases caused by fungi, plant diseases caused by bacteria, virus, mycoplasma , nematodes, and parasitic higher plants. 6 hrs

REFERENCE:

APPLIED MICROBIOLOGY

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2. Rangaswami, G and Bagyaraj, D.J. 1996. Agricultural Microbiology 2nd edition. Prentice Hall of India (Pvt) Ltd. New Delhi.
3. Jay, J.M 1987. Modern Food Microbiology. American Public Health Association. Washington. CBS Publishers. New Delhi.
4. Waites, M.J. 1995. Industrial Microbiology. An introduction. Parima publishing corporation, New Delhi.
5. Demain, D. 1990. Manual of industrial microbiology and Biotechnology. Parima publishing corporation, New Delhi.
6. Pelczar, Jr. Chan, B.C.s and Krej, N.R. 1993. Microbiology. MC Graw Hill-Inc. New Delhi.

7. Prescott, L.M, Harley, J.P and Klein, D.A 1998. Microbiology W M C Brown Publishers. New Delhi.
8. Jerome, J. Perry and James, T. Staley. 1997. Microbiology. Dynamics and Diversity. Sannders College Publishing Co. USA.
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11. Schlegel, H.S. 1986. General microbiology, 6th Ed. Cambridge University Press London.
12. Freeman, J.E. 1982. Advances in microbiology. Ed. Subba Rao, (N.S) Oxford and IBH Co. New Delhi.

APPLIED MYCOLOGY AND PLANT PATHOLOGY

1. Hand book of Applied Mycology series Editor Dilip K. Arora
2. Volume 1 soil and plant edited by Dilip K. Arora Bharat Rai K.G. Mukerji, and gyu R. Knudsen Volume 2 Humans, Animals and Insects edited by Dilip K. Arora, Libero Ajello and K.G. Mukerji,
3. Volume 4 Biotechnology, edited by Dilip K. Arora, Richard P. Elnader , and K.G. Mukerji
4. Volume 5 Mycotoxins in ecological systems, edited by Deepak Bhatnagar, Eivind b. Lillehoj, and Dilip K. Arora,
5. J.E.Smith and D.R. Berry 1975. The Filamentous fungi. Volume I Industrial Mycology Edward Arnold London UK
6. J.E.Smith and D.R. Berry 1975. The Filamentous fungi. Volume II Biosynthesis and metabolism Edward Arnold London UK
7. Agarios, GN (1995) plant pathology, IV Edn Academic press Inc. London New York.
8. Horsfall, JG and Cowling, EB (1977-80) Plant Disease, Vol – I to V Academic press New York.
9. Rangaswamy, D (1988) Disease of crop plants in India, Prentice Hall India, Ltd New Delhi.
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11. Kosuge, T and Nester, EN (1984) Plant microbe interaction – molecular and genetic perspectives, MacMillan, New York.

Bot. CP-4.3.3: PRACTICALS (Based on Bot CT 4.3.3)

APPLIED MICROBIOLOGY

1. Study of diseases caused by Virus and Mycoplasm
2. study of rhizosphere microflora
3. study of phyllosphere microflora
4. Enumeration of micro organisms from spoiled vegetation
5. Examination of VAM in roots and isolation of VAM spores from rhizosphere soil.
6. Isolation and culturing of Rhizobium from root nodules in leguminous plants.
7. Microbial analysis of milk.

APPLIED MYCOLOGY:

1. Stimulatory effect of plant extracts on spore germination of fungal pathogens.
2. Mushroom cultivation.
3. Paper chromatographic separation of amino acids from culture filtrates.
4. Detection and separation of mycotoxins by TLC.
5. Enzymatic reactions – degradation of carbohydrates.

PLANT PATHOLOGY:

1. Market pathology of fruits, vegetables and seeds.
2. Qualitative and quantitative analysis of air borne pathogens.
3. Germination of powdery mildew conidia at different relative humidity levels.
4. Biochemical analysis of diseased plants.

Bot. CT 4.3.4 PHYTODIVERSITY AND ENVIRONMENTAL BIOLOGY

PHYTODIVERSITY

Unit 1. Introduction to phytodiversity and its classification- Genetic, specific and ecosystem diversity 2 hrs.

Unit 2. Floristic diversity in India:

- a. Status of plant diversity
- b. Types of forests and their status
- c. Biogeographic zones of India. 6 hrs.

Unit 3. Climate and vegetation of Karnataka:

- a. Floristics in Karnataka.
- b. Physiography, Geology, Soil and bioclimate of Karnataka
- c. Vegetation of Karnataka- A comparison of Western and Eastern Karnataka.
- d. A brief account of forest covers in Karnataka. 6 hrs.

Unit 4. Special phytodiversity centres:

- a. Concept of Hot Spots
- b. Hot spots in India
- c. Phytodiversity of the Western Ghats
- d. Mangrove ecosystems- Emphasis to Karnataka and Sunderbans.
- e. The Myristica swamps.
- f. The Tropical montane forests. 6 hrs.

Unit 5. Values and conservation of phytodiversity:

- a. Ecological importance of species diversity.
- b. Uses of plants.
- c. Concept of RET plants.
- d. Ex situ and in situ conservation
- e. Biological Diversity Bill. 6 hrs.

ENVIRONMENTAL BIOLOGY

- Unit 1.** Structure and composition of Atmosphere, Lithosphere, Hydrosphere and Biosphere.
Mass and energy transfer across the various interfaces. Material balance. 5 hrs
- Unit 2.** Chemicals in Environment: 5 hrs
- a. Air- Chemical composition of air, ambient air quality standards. Natural and anthropogenic sources of pollution. Primary and secondary pollutants. PAN, Smog, Acid rain and effects of pollutants on biota and materials.
 - b. Water- Chemistry of water. Types, sources and effects of water pollutants. Water quality standards- Physico chemical and Biological.
 - c. Soil- Structure and physico-chemical properties of soil. Soil pollution and control. Soil microorganisms and their function. 5 hrs
- Unit 3.** Environmental toxicology:
Definition, Toxic chemicals, their routes, bioaccumulation (xenobiotics), effects.
Pesticides in water. Biochemical aspects of arsenic, Cadmium, Lead and Mercury. 5 hrs
- Unit 4.** Environmental monitoring and management:
a. Physicochemical and biological monitoring
b. Remote sensing and geographical information system.
c. Biodegradation of pollutants- Role of microorganisms in the degradation of pollutants.
- Unit 5.** Environmental protection and conservation: 5 hrs
Environmental education and awareness. Environmental legislation (a brief review of constitutional provisions and various environmental Protection Acts). Current environmental issues in India. 5 hrs

REFERENCES

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- Krishnamurthy, K.V. 2004. An advanced textbook on Biodiversity Principles and Practice. Oxford and IBH Publishing Co. Pvt. Ltd.
- Mohan Pai, 2005. The Western Ghats. Mrgao Goa.
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- Singh, V.P. and Odaki, K. 2004. Mangrove Ecosystem: Structure and Function. Scientific Publishers, Jodhpur.

PRACTICALS Bot. CP.4.3.4 (Based on Bot. CT 4.3.4)

PHYTODIVERSITY

1. Phytodiversity of wetland ecosystem-Freshwater Plankton Study: Measurement and Diversity.
2. Phytodiversity of Wetland ecosystem- Marine Plankton study.
3. Study of mangroves- morphological and anatomical.
4. Phytodiversity of terrestrial ecosystem:
 - a. Stomatal index
 - b. Study of bark and branching.
 - c. Study of vein-ilets
5. Phytodiversity utilization:
The agarophytes, biofertilizers, biopesticides, medicinal plants etc.

ENVIRONMENTAL BIOLOGY

1. Water Analysis:
 - a. Estimation of BOD and COD
 - b. Estimation of PO₄, SO₄ and NO₃.
 - c. Estimation of Major Cations- Na, K, Ca, Mg and Salinity
2. Effect of DDT and other pesticides on primary production.
3. Effect of Industrial effluent/Heavy metals on seed germination and seedling growth.
4. Estimation of Chlorophyll, Proline, Ascorbic acid in leaves of plants growing in polluted and unpolluted areas.
 - a. Sampling and identification of air spora.
 - b. Estimation of heavy metal content of road side plants.
 - c. Field excursion to an industrial area to assess environmental impact.