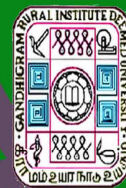


**SYLLABUS**  
**FOR**  
**M.Sc., BOTANY PROGRAMME**  
**(2010 Onwards)**



**Department of Biology**  
**The Gandhigram Rural Institute - Deemed University**  
Gandhigram – 624 302, Dindigul District  
Tamil Nadu, India.

**M.Sc., BOTANY - SCHEME OF EXAMINATIONS**

Semester	Paper Code	Course (Subject)	Hours per week	No. of Credits	Duration of Exam (hrs.)	Continuous formative assessment (CFA) marks		End semester examination (ESE) marks		Total marks	
						Min	Max	Min	Max	Min	Max
I	PBOT0101	Plant Diversity	4	4	3	25	50	25	50	50	100
	PBOT0102	Environmental Biology	4	4	3	25	50	25	50	50	100
	PBOT0103	Systematics and Developmental Botany	4	4	3	25	50	25	50	50	100
	PBOT0104	Molecular Biology	4	4	3	25	50	25	50	50	100
	PBOT0105	Plant Diversity – Practicals & Field	4	2	3	37.5	75	12.5	25	50	100
	PBOT0106	Visit	4	2	3	37.5	75	12.5	25	50	100
	PBOT0107	Environmental Biology– Practicals Village Placement Programme	-	4	-	-	100	-	-	50	100
		Total Credits		24							700

II	PBOT0201	Plant Physiology	4	4	3	25	50	25	50	50	100
	PBOT0202	Elective	4	4	3	25	50	25	50	50	100
	PBOT0203	Computer Applications	2	2	3	25	50	25	50	50	100
	PBOT0204	Biostatistics	4	4	3	25	50	25	50	50	100
	PBOT0205	Computer Application – Practicals	4	2	3	37.5	75	12.5	25	50	100
	PBOT0206	Plant Physiology - Practicals	4	2	3	37.5	75	12.5	25	50	100
	PBOT0207	Seminar	4	2	-	25	50	-	-	25	50
	PBOT0208	Summer Programme – Industrial Training	-	4	-	37.5	75	12.5	25	50	100
			*Gandhi in everyday life	2	2		25	50			25
		Total Credits		26							700

III	PBOT0301	Instrumentation Techniques and Research Methods	4	4	3	25	50	25	50	50	100
	PBOT0302	Cell Biology	4	4	3	25	50	25	50	50	100
	PBOT0303	Genetics and Evolution	4	4	3	25	50	25	50	50	100
	PBOT0304	Fundamentals of Microbiology	4	4	3	25	50	25	50	50	100
	PBOT0305	Instrumentation Techniques and Research Methods - Practicals	4	2	3	37.5	75	12.5	25	50	100
	PBOT0306	Fundamentals of Microbiology- Practicals	4	2	3	37.5	75	12.5	25	50	100
	PBOT0307	Practicals	2	2	-	25	50	-	-	25	50
	PBOT0308	Seminar	-	4	-	50	100	-	-	50	100
			Village Placement Programme								
		Total Credits		26							750
IV	PBOT0401	Plant Resource Utilization and Conservation	4	4	3	25	50	25	50	50	100
	PBOT0402	Biotechnology & Genetic engineering	4	4	3	25	50	25	50	50	100
	PBOT0403	Biochemistry	4	4	3	25	50	25	50	50	100
	PBOT0404	Extension	2	2	-	25	50	-	-	25	50
	PBOT0405	Seminar	2	2	-	25	50	-	-	25	50
	PBOT0406	Dissertation	12	6	-	37.5	75	62.5	125	100	200
			Total Credits		22						

**Total Credits = 24 + 26 + 26 + 22 = 98**

**Grand Total of Marks = 700 + 700 + 750 + 600 = 2750**

## **Elective Courses**

1. Medical Botany
2. Mushroom Biotechnology
3. Horticulture, Plant Breeding and Plant Pathology
4. Biofertilizers & Bioinsecticides
5. Plant Ecology

**Unit I****Phycology**

Classification of algae by Frisch; General characteristics of all classes of algae; Habitat, thallus organization, reproduction (vegetative, asexual, sexual) and life cycle of *Chlorella* and *Geledium*; Phylogeny and economic importance of algae.

**Unit II****Mycology**

Classification of fungi by Alexopoulos; General characteristics of all classes of fungi; Habitat, thallus organization, reproduction ((vegetative, asexual, sexual) and life cycle of *Rhizopus* and *Agaricus*; Phylogeny and economic importance of fungi.

**Unit III****Bryophytes**

Classification of bryophytes by Rothmaler; General characteristics of all classes of bryophytes; Habitat, Vegetative and anatomic structures, reproduction (vegetative, asexual, sexual) and life cycle of *Marchantia* and *Funaria*; Phylogeny and economic importance of Bryophytes.

**Unit IV****Pteridophytes**

Classification of pteridophytes by Smith; General characteristics of all classes of pteridophytes; Vegetative, anatomy, reproduction and life cycle of *Lycopodium* and *Adiantum*; Phylogeny and economic importance of Pteridophytes.

**Unit V****Gymnosperms & Paleobotany**

Classification of gymnosperms by Sporne; General characteristics of all classes of gymnosperms; Vegetative, anatomy, reproduction and life cycle of *Gnetum*; Phylogeny and economic importance of Gymnosperms. Brief account of process of fossilization, type studies on *Rhynia* and *Leginoptis*.

**Reference Books**

- 1) B.R Vasista, 1992, Algae, S. Chand and company ltd. New Delhi.
- 2) H.D. Kumar and H.N. Singh. 1996. A textbook Algae. Affiliated East West Pvt Ltd Madras.
- 3) Gilbert. M. Smith 1998. Cryptogamic Botany Volume 1 and 2 Tafa Mcgrao – Publishing Company Ltd, New Delhi.
- 4) B. P. Pandey 2004. College botany Volume 1 and 2 S. Chand and company Ltd ,New Delhi.

**Unit I**

History of environmental biology – Scope of environmental biology – Aut ecology and synecology – profile of atmosphere, hydrosphere and lithosphere – population ecology – Environmental factors (physical, chemical and biological) and their influence on living organisms.

**Unit II**

Ecosystem – Structure and functions – Types – Terrestrial – Forest, grass land – Aquatic – Fresh water and Marine – Food chain and food web – Ecological pyramids – pyramid of biomass, number and Energy – Productivity – Primary productivity – Measurement of primary production – Factors influencing primary production –secondary productivity – Biogeochemical cycles – oxygen, carbon, nitrogen, sulphur and phosphorus.

**Unit III**

Resources – conservation and Environmental education. Resources – Aquatic –Land, forest and wild – life – conservation and Management – National Parks and sanctuaries – Biosphere reserves – Remote sensing. Environmental education – objectives, goals, scope, guiding principles, environmental education programmes and Centre for Environmental education.

**Unit IV**

Environmental pollution – Types (Air, water , soil and radio active) and their biological effects – Prevention and control through law – Environmental protection Act 1986 – Pollution control boards – Earth Summit 1992 and its outcome - Environmental Impact Assessment – Public participation in Environmental - Decision making – Methods of Impact analysis – Environmental audit.

**Unit V**

Environmental standards (Air and water) and Environmental monitoring – Domestic, industrial and agricultural waste recycling – physical, chemical and biological treatment of liquid effluents – Bio monitoring – scope, objectives and parameters – Bio indicators and environmental monitoring – Microorganisms, lower plants, higher plants and animals – significance and advantages – Bio assay and its application in environment.

**References**

1. H.D. Kumar 1995 General Ecology. Vikas pub. House, New Delhi. pp. 258 – 302; 556-598
2. Trivedi, P.R. 1996 Encyclopedia of environment pollution, planning and conservation Aph pub. Corporation, New Delhi. Vol. 2; 45 – 144

3. Kailash Thakur 1997 Environmental protection law and policy in India. Deep and Deep Pub. New Delhi. pp. 184-197; 210 – 248.
4. Ramesh Ghanta and Digumarti Bhaskara Rao 1998 Environmental education – problems and prospects – Discovery pub. House, New Delhi pp1-14.
5. Kaiser Jamil 2001 Bio indicators and biomarkers of Environmental pollution and Risk assessment. Oxford and IBH Pub. Co. Pvt. Ltd, New Delhi. pp.1 – 168.
6. Sharma, P.D. 2002 Environmental biology Ratogi and company, New Delhi : pp – 315 – 373; 517-530
7. Agarwal, S.K. 2002 Eco – informatics. Vol I, III, IV APH pub. Company, New Delhi. Vol. I: 135 – 165 : 265 – 311; Vol. III : 221 – 259; Vol. IV : 1-140.
8. V.S. Kulkariani, S.N. Kaw and R.K. Trivedy 2002. Environmental Impact Assessment for wetland protection. Scientific publishers (India). Jodhpur pp: 4 – 24; 49 - 62
9. R.K. Trivedy 2000 Pollution and biomonitoring of Indian rivers. ABD publishers, Jaipur, India. pp.1-332.
10. B.K. Sharma and H. Kaur 1994 1994 Environmental Chemistry. Goel pub. House, Meerut. Pp. 47-515



**Unit I****Introduction to Systematics**

Definition and importance of taxonomy; Pre Darwinian and post Darwinian theories of biological classification, detailed study of Bentham and Hooker's classification, comparative study of classification of Engler, Bessey, Linnaeus, Hutchinson and Takhtajan.

**Unit II****Principles and systems of classification**

Plant nomenclature; evaluation of ICBN, author citation, types method and different types, publication of names, construction of taxonomic keys and their utilization; floristic studies in India, role of BSI.

**Unit III****Important families and Ethnobotany**

Study on the diagnostic features and economic importance of selected families of dicots (Brassicaceae, Rutaceae, Leguminosae, Apiaceae, Lamiaceae, Euphorbiaceae) and monocots (Liliaceae, Arecaceae, Poaceae).; Ethnobotany-ethnic societies of Tamilnadu and their traditional herbs, medicines derived from herbal drugs.

**Unit IV****Anatomy**

Origin, structure and functions of Cambia, structure of wood, nodal anatomy, root-stem transition; scope of histo chemistry and cytochemistry

**Unit V****Embryology**

Microsporogenesis, male gametophyte, pollen fertility and sterility, pollen storage; megasporogenesis, embryo sac types, pollination, fertilization, incompatibility, development embryo, endosperm and seed; polyembryony, parthenocarpy.

**References**

- 1) V. Singh and D. K. Jain. 1997. Taxonomy of Angiosperms Rastogi publications. Shivaji Road Meerat.
- 2) K.S. Bilgrami, L.M. Srivastava, J.L. Shree Mali 1999. Fundamentals of botany. Vikas publishing house Ltd, sahibabad UP.
- 3) V. Singh, P.C. Pande, D.K. Jain, 1997. A text book of botany Angiosperms. Rastogi Publications Shivaji road Meerat.

- 4) V. V. Sivarajan, 1996. Principles of plant taxonomy Oxford and IBH publishing Co. Pvt Ltd, New Delhi, .
- 5) Subramanyam,N.S,1999 ModernPlant Taxonomy,Vikas Publishing House,New Delhi.
- 6) Esau,1987.The anatomy of seed plants.Wiley Eastern Ltd,New Delhi.
- 7) Fahn,A,1989.Plant anatomy,Peragamon Press,Oxford,New york.
- 8)Kierman,J.A.1999.Histological and Histochemical methods.Butterworth Publications, London.
- 9) B.P. Pandey,1995 . Embryology of Angiosperms S. Chand and Company Ltd., Ram Nagar, New Delhi.
- 10) Pandey,S.N. and Chadha,A,2000.Embryology Vikas Publishing House,New Delhi.

**Unit I**

Introduction and historical development, Structure of DNA - primary, secondary and different forms (A, B, C Z) and Protein. Central dogma of Molecular biology. The Logic of molecular biology – the efficient argument, examination of models and strong inference. Molecules of life – DNA world – RNA world and protein world. Prokaryotic and Eukaryotic Chromosome organization. Genes – definition, types and functional organization.

**Unit II**

Mutation – Types – Molecular and biochemical basis of mutation. Mutagenesis – Spontaneous and induced – Base – analog, physical agents, chemical mutagens, intercalating substances and mutator genes. Reversion – definition – Types – Mechanisms – application (Ames test). Mutants – Types and Uses.

**Unit III**

DNA Replication - basic rule. The Geometry of DNA replication – Semiconservative replication of double – stranded DNA and Circular DNA molecules. Enzymology – DNA Polymerases I and III, DNA ligase and DNA gyrase. Events in the replication fork – Continuous and discontinuous. Plasmid and  $\phi$ 174 DNA replication. DNA damage – repair mechanism – DSOS function

**Unit IV**

Transcription – basic factors of RNA Synthesis. RNA polymerases – I, II and III. Mechanisms – RNA Chain Initiation, elongation and termination. Classes of RNA Molecules – Messenger, ribosomal and transfer RNA. RNA splicing mechanisms – Spliceosomes, Group I and Group II introns. Self-splicing. Capping and tailing of 5' and 3' termini of Eukaryotic mRNA molecules.

**Unit V**

Translation – Outline of protein synthesis. Genetic code – Definition, deciphering of codons – Universality of the code – Wobble hypothesis and codon dictionary. Regulation of gene expression in prokaryotes – the operon model. Lactose, galactose and tryptophan operon. Feed back inhibition and Allosteric enzymes.

**Text Book**

1. David Freifelder, 1996, Molecular Biology, 4<sup>th</sup> Reprint., Narosa Publishing House, New Delhi, India.

## References

1. R.F. Weaver and P.W. Hedrick 1992, Genetics Wh.C.Brown publishers, Dubuque.
2. S.C. Rastogi, V.N. Sharma, Biology & Biotechnology, Vikas Publishing House Pvt. Ltd., New Delhi.
3. H.D. Kumar, 1993, Molecular Biology & Biotechnology, Vikas publishing house Pvt. Ltd., New Delhi.
4. David Freifelder, 1996, Molecular Biology 2<sup>nd</sup> ed., Jones and Barflett publishers, Inc. Boston.
5. E.J. Gardener *et al.*,. 1991 Principles of Genetics (8<sup>th</sup> Ed., ) John Wiley & Sons, New York.
6. B. Lewin 1997 Genes VI Oxford University press.

**PBOT0105 PLANT DIVERSITY PRACTICAL & FIELD VISIT Credits – 2**

1. Field visit, observation of local algal flora.

2. Observation, vegetative and reproductive structures of the following.

- *Fungi* : *Rhizopus, Agaricus*
- *Bryophytes* : *Marchantia, Funaria*
- *Pteridophytes* : *Lycopodium, Adiantum*
- *Gymnosperm* : *Gnetum*

3. Study of representative members of the prescribed families.

4. Field work for the study of local flora, preparation of dichotomous key.

5. Preparation and submission of 15 herbaria.

6. Free hand section showing localization of protein, sugars.

7. Preparation of double stain free hand sections on normal secondary thickening.

8. Study of pollen types.

9. Developmental stages of anther, ovule, embryo and endosperm.

**PBOT0106 ENVIRONMENTAL BIOLOGY – PRACTICALS Credits - 2**

1. Estimation of dissolved solids.
2. Estimation of dissolved oxygen
3. Estimation of carbondioxide
4. Estimation of BOD in different water samples.
5. Estimation of COD in different water samples.
6. Estimation of Chloride.
7. Estimation of Total hardness.
8. Quadrant study on population.
9. Bioassay studies on pesticides using fish, aquatic insects and larvae.
10. EIA of Project.

**Unit I****Plant –water relations**

Cell wall architecture and its role in plant cells. Absorption of water and minerals, translocation, transpiration and mineral nutrition-Definition, pathway, mechanism, factors and significance.

**Unit II****Carbohydrate metabolism**

Photosynthesis – Definition, pigments and absorption spectra, mechanism of photosynthesis, factors, significance; C<sub>4</sub> cycle, CAM pathway and photorespiration. Respiration – Definition, types, mechanisms and energetics, factors and significance.

**Unit III****Nitrogen and fat metabolism**

Nitrogen metabolism – NO<sub>3</sub>, NH<sub>3</sub> assimilation, biosynthesis of amino acids, nitrogen fixation, free living fixing organisms, enzymes involved; Lipid metabolism –  $\beta$  Oxidation and Glyoxalate cycle.

**Unit IV****Growth and development**

Growth and development – differentiation: growth hormones – their mode of action and physiological role, Physiology of flowering, phytochrome as photoreceptor – mode of action, photoperiodism – vernalisation, fruit set and ripening, germination and dormancy, senescence, aging and death.

**Unit V****Stress physiology**

Introduction, Environmental stress – Biotic and Abiotic; water, saline, heavy metal, frost, radiation stresses, heat shock response, biorhythms-basic concepts, characteristics & significance of biological clocks and circadian rhythm.

**References**

- 1) S. K. Verma, 1995. A text book of Plant Physiology and Biochemistry. S. Chand and Company Ltd. Ram Nagar, New Delhi.
- 2) R. K. Sinha, 2004. Modern Plant Physiology. Narosa publishing House, New Delhi, Chennai, Mumbai.
- 3) S. Mukhejji, A. K. Ghosh, 1996. Plant Physiology. Tata Mcgraw- Hill publishing Company Ltd. New Delhi.
- 4) Devlin and Witham, 1996. Plant Physiology CBS Publishers and Distributors. 485, Jain Bhawan, Bholu Nath Nagar, Shahdara, Delhi-110032

- 5) B. R. Vashishta, 1996. Fungi. S.Chand and company Ltd, Ram Nagar, New Delhi-110055.
- 6) John Charles Walker,1997. Plant Physiology. MCgraw – Hill book Company, inc New York, Toronto, London. Kogakusha Company, Ltd. Tokyo.
- 7) K. S. Bilgrami, H.C.Dube, 2001. A text book of Modern Plant Pathology. Vikas Publishing house Pvt Ltd. Ansari road, New Delhi – 110002.



**Unit I**

Data Processing using MS-ACCESS 2000: Data base – definition – Problems with manual data base – advantages of using computer for maintaining data base – terms: field 0 data type – record – file – database file – primary key – secondary key – GUI – Back end – front end – introduction to MS-ACCESS – Creating database – opening an existing database – objects – open object – copy – delete – import – export – preview data – print – view object properties – display property sheet – creating table – save – table window (design view) – add field - define data type – move field – delete field – set primary key – open table –add records to table – print: table records – selected records – setting table relationship – view – edit – delete.

**Unit II**

MS –ACCESS : Data sheet : Adjust column width and row height – move column – hide and unhide – change font - Queries : Create – modifying existing one – run – view – cancel – save – select records – set criteria – single field – multiple field – getting help – forms and reports.

**Unit III**

Introduction to VISUAL BASIC -special features – project – definition – crating project – opening existing project – form – definition – properties – controls – pointer – picture box – label – text box – frame – command button – check box – option button – combo box – list box – simple programs using the above controls.

**Unit IV**

VISUAL BASIC : Horizontal and vertical scroll bar – timer control – drive list box – directory list box – file list box – shape control – line control – image control – data control – grid control – animated button control - common dialogue box – message box – input box – simple programs using MSI the above controls.[]

**Unit V**

VISUAL BASIC Language reference: Form coding - objects and declarations – variable declarations – IF statement – GOTO statement –FOR Loop – WHILE Loop –Do Loop –SELECT CASE Structure – built – in functions – database objects – snapshot – dynaset – ODBC – error handling – save form – run form – run project – debug – save – close. Case study:

- Student mark statement sheet processing
- Employee payroll preparation
- Inventory Control
- Library management
- Online ticket reservation system

## **References**

1. Microsoft Office 2000 - Rebecca J, Fiala, Jeff Grisenthwaite, Maria reid, Karl Schwartz, Cathy vesecky, BPB publications, New Delhi – 110 002, 1999.
2. Teach yourself Visual Basic 6 by Scott warner, Tata McGraw Hill Publishing Company Limited, New Delhi, 1999.

**Unit I****Introduction to Statistics**

- a) Statistics – Definition, Scope, functions and limitations; Development of Biostatistics and its applications.
- b) Sources of statistical data, Secondary and Primary sources; Statistical set up in India; Statistical organizations.
- c) Representation of data; classification and tabulation of data; frequency distribution; Diagrammatic and Graphical representation of statistical data – Bar diagrams, Pie Chart, Line graph, Pictogram, Histogram, Frequency polygon, Frequency curve, Ogive.

**Unit II****DESCRIPTIVE STATISTICS**

- a) Measures of central tendency – Objects of various measures – mean, median and mode, uses, merits and demerits.
- b) Measures of Dispersion; Objects : Measures – range, quartile deviation, mean deviation standard deviation, absolute and relative measures of dispersion, uses, merits and demerits.

**Unit III****SAMPLING AND THEORETICAL DISTRIBUTIONS**

- a) Sampling – meaning, advantages, concept of parameter and statistics, sample size, sampling error, sampling frame, types of samples – Probability samples – Simple random sample, stratified random sample, systematic sample, cluster sample, Multi stage and area sample. Non-Probability samples – purposive sampling, quota sampling, accidental sampling, volunteer sampling and snowball sampling.
- b) Introduction of probability and its applications –Theoretical Distributions – Binomial, Poisson and Normal distributions; Properties, uses and applications.

**Unit IV****CORRELATION AND REGRESSION ANALYSIS**

Theory of correlation and regression. Definition, uses, types and correlation, Regression Lines – Properties of regression coefficients.

**Unit V****TESTING OF HYPOTHESIS**

- a) Test of attributes, small and large sample tests.
- b) Analysis of variance – one-way and two-way classification.

- c) Non-parametric and Distribution Free Tests - Chi-Square test and Contingency coefficient

### **References**

- a) Arora P.N. Malhan P.K. Biostatistics, Delhi : Himalaya PublishingHouse, 1996.
- b) Daroga Singh, Chaundjari F.S. Theory and Analysis of Sample survey, New Delhi; Wiley Eastern Ltd., 1986.
- c) Gupta C.B. An Introduction to statistical methods New Delhi; VikasPublishers,1992.
- d) Gupta, S.P. Statistical Methods, New Delhi: Sultan Chand, 1992.
- e) Palanichamy S. and Manoharan M. Statistical Methods for Biologists.

**Experiments / Determination of**

- 1) Plasmolysis.
- 2) Transpiration rate.
- 3) Soilless growth (Hydroponics).
- 4) Effect of Monochromatic light on Photosynthesis.
- 5) Quantification, absorption spectra of chlorophyll and carotenoids.  
Spectra of Chlorophyll and carotenoids.
- 6) Hill activity by DCPIP/ferricyanide reduction.
- 7) Estimation of Protein, Lipid, Carbohydrate.
- 8) Estimation of CO<sub>2</sub> evolved during respiration.
- 9) Demonstration of liberation of heat energy during respiration.
- 10) Measurement of growth – Lever auxanometer.
- 11) Estimation of IAA.
- 12) Determination antioxidants spectra of ascorbic acid and  $\beta$  carotenoids.

**PBOT0301 INSTRUMENTATION TECHNIQUES AND RESEARCH METHODS**  
**CREDITS – 4**

**Unit I**

General laboratory procedures and maintenance of research equipments – Microscopy – General principles. Micrometry, image analysis and video microscopy. P<sup>H</sup> Measurements – basic principles and construction of P<sup>H</sup> Metrer - P<sup>H</sup> electrodes – The Clark oxygen electrode principles and applications. Buffers – buffer action and preparation of buffers – Citrate, Acetate, Tris, Phosphate buffers. P<sup>H</sup> Measurements of soil, sewage and tannery effluent.

**Unit II**

Isolation and fractionation of cellular constituents. Homogenization, Manual, Mechanical and sonication. Basic principles of sedimentation. Centrifugation – centrifuges and their uses – small bench centrifuges, large capacity refrigerated centrifuges, High speed refrigerated centrifuges, Preparative ultra centrifuges, Analytical ultracentrifuges. Differential centrifugation, Density gradient centrifugation, Isolation of chloroplasts, Mitochondria, nucleic acids and enzymes.

**UNIT III**

Chromatographic and Electrophoretic methods – Chromatography, Low pressure column chromatography, High performance liquid chromatography adsorption chromatography, partition chromatography, ion – exchange chromatography, molecular exclusion chromatography, affinity chromatography, gas – liquid chromatography, thin – layer chromatography & paper chromatography – separation of amino acids and sugars using chromatography. Electrophoresis – Principles, Factors affecting electrophoretic mobility – Support medium - Agarose gels, polyacrylamide gels - Two dimensional poly acrylamide gel electrophoresis, cellulose acetate electrophoresis, capillary electrophoresis. Electrophoresis of proteins and nucleic acids.

**UNIT IV**

Colorimetry - spectroscopic techniques : UV- Visible light, AFS, AES, AAS – Principle, Instrumentation and applications. Estimation of cellular constituents such as sugars, amino acids and proteins using spectro photometry. Bomb calorimeter – principle and applications.

**UNIT V**

Research – objectives, types and importance – Research methods in biological Sciences – Research process – Literature survey – presentation of research work – Part of thesis – article writing, publication and presentation.

## References

1. S. Palanichamy and M. Shunmugavelu 1997. Research methods in biological sciences. Palani paramount publications, Palani.
2. David T. Plummer 1998. An introduction to practical biochemistry, Tata Mc Graw Hill pub. Co. Ltd, New Delhi.
3. J. Jeyaraman 1991. Laboratory Manual in Biochemistry. New Age International publishers, New Delhi.
4. Keith Wilson and John Walker 2002 practical biochemistry – Principles and techniques. Fifth edn. Cambridge Univ. Press.
5. K. Kannan 2003 Hand book of Laboratory culture media, reagents, stains and buffers Panima publishing corporation, New Delhi.
6. P. Asokan 2002. Analytical biochemistry – Biochemical techniques. First edition Chinnaa publications, Melvisharam, Vellore
7. Rodney Boyer, 2001. Modern Experimental Biochemistry. III Ed. Addison Wesley Longman Pte. Ltd, Indian Branch, Delhi, India.
8. N. Gurumani, 2006 Research Methodology for Biological Sciences. MJP Publishers, Chennai.

**Unit I**

Ultrastructure of plant and animal cell - Cell membrane: Structure and function – Variation among membrane – molecular organisation of plasma membrane – models – (Unit membrane – Dawson Danielli model – Fluid mosaic model) membrane functions – permeability of plasma membrane to water and solutes – conc. gradients – movements of ions – Passive diffusion – Active Transport – pinocytosis – phagocytosis. Modifications of plasma membrane - microvilli – tight junctions – Desmosomes – Cell – Cell surface adhesion – Cell – non-cellular surface adhesion – inter-cellular recognition.

**Unit II**

Endoplasmic reticulum – Morphology – chemical composition – distribution – ER membrane – Role of ER in plant cell – special functions of ER – synthesis. Mitochondria – morphology – chemical composition – mitochondrial DNA and RNA – Enzyme distribution – functions. Golgi complex – Morphology – electron microscopic structure – functions – synthesis of glycoproteins secretion – recycling of secretory granules – lipid packing and secretion – Acrosome formation – Regulation of fluid balance. Ribosomes – structure – types – functions.

**Unit III**

Osmophilic granules – Pyrenoids – organisation – photosystem I and II. Lysosomes – Identification – enzymatic content of lysosomes – functions. Ribosomes – structure – types – biosynthesis - function. Centriole –structure and function ,vacuoles,nonliving cell inclusions of plants.

**Unit IV**

Nucleus – ultra structure of nuclear membrane – chemical composition – function. Chromosomes – structure – euchromatin – heterochromatin – centromeres – banding – polytene and lampbrush chromosomes – nucleolus – structure, composition – function.- Cell growth – cell cycle – mitosis – cellplate formation – meiosis – Genetic consequences of meiosis.

**Unit V**

Human Karyotype – Abnormalities of human chromosome Biology of cancer cells – cellular oncogens – Ageing - Radiation effects on cells – Animal tissue culture.

**References**

1. Gerald Karp, Cell Biology, II Edition – McGraw Hill International Book Co.
2. B.D.F. Robertis , Cells and Molecular Biology (1991) – Sounders College – 1981.
3. A.C. Giese, 1999 - Cell Physiology, 5<sup>th</sup> edition, W.B. Sounders Company
4. Chariotte J. Averse (1995) Molecular Cell Biology – Addison Wesley Publ. Co.
5. Gupta and Janis, The Cell and Biotechnology, 1st Edition (1991) –Agro Botanical



Publ.

6. P.K.G. Nair and K. Prabhakar Achar. 1999. A Text Book of Cell Biology. Konark Publishers Pvt. Ltd., Delhi.
7. S. Sundara Rajan 2003. Introduction to Cell Biology. Vikas Publishing House Pvt. Ltd., New Delhi.
8. P.S. Verma and V.K. Agarwal 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company, New Delhi.

**Unit I**

Mendelian inheritance: Law of dominance – segregation – independent assortment. Expression and interaction of genes – Complementary genes – Supplementary genes – Epistasis. Multiple alleles: blood group – Rh factor – multiple gene inheritance – simple mendelian traits in man - Eugenics – human betterment

**Unit II**

Sex determination and Sex linked inheritance: Sex determination in drosophila – man – genetic balance theory – male haploidy – Gynandromorphs – eye colour inheritance – Haemophilia – congenital night blindness – Y linked inheritance – sex limited genes – sex influenced genes – free martin.

**Unit III**

Linkage and crossing over: Coupling and repulsion – arrangement of genes – Expression of linkage – Linkage groups – complete and incomplete linkage – Theories – factors affecting linkage – Crossing over – Theories – kinds – factors affecting crossing over – frequencies of crossing over – significance – Molecular mapping methods- RFLP, Chromosome walking and chromosome jumping - Chromosome and ploidy - Cytoplasmic inheritance: Predetermination – virus like inclusions and infective particles – the milk factor- The Kappa particles – plastid inheritance – maternal inheritance.

**Unit IV**

Evolution – Origin of life – Concepts and theories of organic evolution – Mimicry- Types – speciation – Types – Factors influencing speciation.

**Unit V**

Hardy Weinberg law – Adaptive radiation – Inter-relationship among animals – Extinction – Evolution of Man – Fossil record.

**References**

1. Edmund W. Sinnott, L.C. Dunn and T.Dobzhansky 1990, Principles of Genetics, 5th edition, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Carl P. Swanson., Thimathy Merz and William J. Young 1990, Cytogenetics, Prentice – Hall of India, New Delhi.
3. Curt Stern(Recent Edition) Principles of Human Genetics, Eurasia publishing House Pvt. Ltd., New Delhi.
4. P.L. Kochhar 1992 Genetics and Evolution, Ratan Prakashan Mandir Educational Publishers, Agra – 2.
5. Goodenouth, U 1984, Genetics 3<sup>rd</sup> edition CBS College Publishing, Halt, Rineshait and Winstion.

6. Eldon J. Gardner 1975, Principles of Genetics 5<sup>th</sup> edition, John Wiley and Sons, New York.
7. E. Peter Volpe 1996 Understanding Evolution Win C. Brown Company Publishers, New Delhi.
8. Theodosius Dobzhansky, Francisco J. Ayala G. Ledyard Stebbins & James W. Valentine. 1996. Evolution. Surjeet Publications, Delhi.
9. N. Arumugam 1993. Cytology, Genetics & Evolution. Saras Publications, Nagercoil. Publications. New Delhi.

**Unit I**

Historical and recent developments - Spontaneous generation, germ theory of disease and development of medical microbiology, microbial genetics, physiology, virology, plant pathology, soil microbiology, industrial microbiology and molecular biology.

Microscopy: Simple, Compound, Dark field, Phase contrast, Fluorescence and Electron microscopy.

**Unit II**

Ultra structure of Prokaryotic and Eukaryotic cell:- The Prokaryotic Cell: Size, shape and arrangement of bacterial cells; structure of cell wall, and structures external (glycocalyx, flagella, pili, etc.) and internal (plasma membrane, cytoplasm, inclusion bodies, etc.) to the cell wall. The Eukaryotic Cell: Cilia, flagella, cytoskeleton, cytomembrane systems, mitochondria and chloroplast Comparison of Prokaryotic and Eukaryotic cell.

**Unit III**

Sterilization: Dry Heat, Moist Heat, Filtration, Tyndallization, Pasteurization, Radiation, Antimicrobial Chemicals- classification - mode of action - antibiotic resistance - tests for antibiosis.

**Unit IV**

Cultural techniques: pure culture techniques, types of media - media preparation - preservation of cultures - aerobic and anaerobic culture techniques - growth of bacteria: batch and synchronous culture - factors influencing growth - growth curve. Methods to study microbial morphology - wet mount and hanging drop method. Staining techniques - Gram's, acid fast, spore and capsule staining.

**Unit V**

Microbe – human interaction: Infection and disease – Resident Flora – Pathogenicity and virulence – Varied Pattern of infection – Epidemiology – infectious diseases – recognition of an infectious disease in a population – recognition of an epidemic – the infectious disease cycle – study of disease – virulence and the mode of transmission – the emergence of new diseases – control of epidemics.

**Text Book**

1. Pelczar, Jr., Michael, E. C. S. Chan and Noel Kreig. (2000). Microbiology. V Ed. Tata McGraw Hill Book Company.
2. Brock, T. D., Smith, D. W and Madigene, M. T. 1997. Biology of Microorganisms: Milestones in Microbiology. Prentice-Hall International Inc. London.

## References

1. Hans G. Schlegel. 2002. General Microbiology. VII Ed. Cambridge University Press. UK. pp: 193 – 231.
2. John L. Ingrahm and Catherine Ingrahm.. 2000. Introduction to Microbiology. II Ed. Brooks/Cole, Thompson Learning division. USA. pp: 86 – 117.
3. Lansing M. Prescott, John P. Harley and Donald A. Klein. 1999. Microbiology. IV Ed. WCB/McGraw Hill Company. pp: 1- 95; 135- 147.
4. Stanier, Y. Roger, John L. Ingrahm, Mark L. Wheelis and Page R. Painter. 2003. General Microbiology. V Ed. MacMillan Press Ltd. New Jersey. pp: 621-626; 655-670.
5. Salle, A. J. 1992. Fundamental Principles of Bacteriology. VII Ed. McGraw Hill Publishing Co. Ltd. pp: 251-270.
6. Sundararajan, S. 2003. Microorganisms. I Ed. Anmol Publications Pvt. Ltd. New Delhi. pp: 1 – 62.

**PBOT0305 INSTRUMENTATION TECHNIQUES AND RESEARCH  
METHODS-PRACTICALS**

**Credits – 2**

1. Preparation of buffers and determination of  $P^H$  using  $P^H$  meter
2. Differential and density gradient centrifugation
3. Separation of amino acids and sugars using paper and thin layer chromatography
4. Acetylene reductase assay and ethanol estimation using Gas Chromatography.
5. Separation of proteins and nucleic acids using paper and gel electrophoresis
6. Verification of Beer – lamberts law using spectrophotometer.
7. Estimation of Na, K, Ca and Mg using Flame photometer.
8. Estimation of calorific value of different feed / fire wood samples.

**References**

1. Rodney Boyer, 2001. Modern Experimental Biochemistry. III Ed. Addison Wesley Longman Pte. Ltd, Indian Branch, Delhi, India.
2. J. Jeyaraman 1991. Laboratory Manual in Biochemistry. New Age International Publishers, New Delhi.

**PBOT0306 FUNDAMENTALS OF MICROBIOLOGY PRACTICALS**  
**Credits-2**

1. a) Safety measures to be followed in a laboratory.  
b) Cleaning of Glasswares  
c) Handling and Care of Microbiological Instruments.
2. a) Preparation of Culture Media for Microorganisms.  
b) Demonstration of Techniques for Pure Culture of Micro-organisms by Serial Dilution Techniques using
  - i) Streak Plate method.
  - ii) Pour Plate method
  - iii) Spread Plate method
3. a) Microscopic Examination of Living Organisms – Demonstration of Motility.  
b) Measurement of Microorganisms using Micrometry.
4. Staining Techniques – Gram’s staining, Acid-fast staining, Spore Staining, Metachromatic granules staining.
5. Isolation of Bacteriophage from Sewage.
6. Milk Analysis
  - a) Qualitative Analysis of Milk by Standard Plate Count Method.
  - b) Enumeration of Bacteria in Milk and Presumptive Test for Coliforms.
  - c) Methylene Blue Reductase Test Method.
  - d) Determination of Phosphatase Activity of Milk
7. a) Standard Qualitative Analysis of Water
  - i) Presumptive Test for Coliform Group of Bacteria.
  - ii) Confirmed Test of Coliform Bacteria.
  - iii) Completed Test for Coliform Bacteria.b) Water Analysis for Total Bacterial Population by Standard Plate Count Method.
8. Isolation and Enumeration of Bacteria, Fungi and Actinomycetes from Soil.
9. Isolation of Protozoa from Soil.
10. Isolation of VAM Spores from Soil.
11. Isolation of yeast from grapes.
12. Demonstration of Spore Germination (Fungus)
13. Isolation of Micro Flora from Human skin and Throat.
14. Urine Culture and its Microbial Analysis.

## **References**

1. Dubey, R.C and Maheswari, D.K. (2002). Practical Microbiology, I Ed., Chand and Company Ltd., India.
2. James. G. Cappucino. And Natabe Sherman, (2004). Microbiology – A Laboratory Manual, VI Ed., (I Indian Reprint). Pearson Education (Singapore) Pvt. Ltd., India.



**PBOT0401 PLANT RESOURCE UTILIZATION & CONSERVATION**

**Credits - 4**

**Unit I**

**Plants and food**

Plants as food Introduction; Botanical name, family, morphology of useful parts and uses of the following: Cereal, Paddy, Millets, Sorghum; Legume-Blackgram; NUT-Ground nut; Vegetable-Tomato; Fruit-apple.

**Unit II Plants and commerce**

Plants for commercial exploitation; Botanical name, family, morphology of useful plants and uses of the following: Fibre-cotton, Wood-Teak; Tannin-Myrobalan; Latex-Rubber; Essential oil-Coconut oil; Sugars-Sugarcane; Spices and condiment-Cordamom, Peper; Dyes-Indigo; Gum-gum arabic

**Unit III Sustainable development**

Basic concepts, origin of agriculture-world centres of primary diversity of domesticated plants, green revolution-benefits and adverse consequences, innovations for meeting world food demands

**Unit IV Plants and Conservation**

Strategies for conservation-In-situ, ex-situ-principles and practices, International efforts and Indian initiatives, general accounts of BSI, NBPGR, ICAR, CSIR, DBT for conservation and nonformal conservation efforts.

**Unit V Biodiversity Management**

Biodiversity management-organizations involved, legislation and conventions, biodiversity information and communication; biodiversity prospecting and indigenous knowledge systems, biopiracy, IPR, problems and prospects of participatory management.

**References**

1. Pandey, B.P, 1998. Economic Botany, S. Chand & Co., New Delhi.
2. Sambamurthy, A. V. S. S. and Subramanian, N. S. 1999. A text Book of Economic Botany, Wiley Eastern Limited, New Delhi
3. Chadel, K. P. S., Shukla, G. and Sharma, N. 1996. Biodiversity of medicinal and aromatic plants in India. Conservation and Utilization. National Bureau of plant genetic Resources, New Delhi.
4. Frankel, O. H. Brown, J. J. 1995. The conservation of plant diversity. Cambridge University Press, Cambridge.
5. Swaminathan, M. S. and Cocchar S. L. (Eds) 1999. Plants and society. Macmillan Publications Ltd. London.
6. Hill, F. 1992. Economic Botany. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
7. K. V. Krishnamurthy, 2003. An advanced text book on biodiversity Oxford and IBH Publishing Co. Pvt Ltd. New Delhi.

### **Unit I**

**Concepts and Scope in bio-technology:** Plant cell and tissue culture – Culture techniques – Protoplast technique – Anther and pollen culture. Animal tissue culture-culture techniques – Animal bio reactors. Gene banks and Germ plasm storage. Immobilization of microbial cells / enzymes – Adsorption, entrapping, ionic bonding, cross linking, encapsulation and microencapsulation. Application of immobilized enzymes.

### **Unit II**

Fermentation technology – Model fermenters – bioprocess monitoring – Down stream processing. Biotransformation and production of useful compounds – Glycerol, acetons, Alkene oxide, Ploy hydroxy butyrate, Xanthangum and Microbial Leaching. Biosensors – definition, outline design and types – Biosensors nutrients – glucose and acetic acid sensors. Sensor for cell population – Fuel cell type electrode, potentiostatic, piezoelectric membrane – Dye-coupled electrode membrane filter – Oxygen electrode system and Lactate sensor. Biosensor for products - alcohol sensor, formic acid sensor and methane sensor. Biosensor for environmental control – BOD sensor, Ammonia sensor, Nitrite sensor and Sulfite Ion sensor.

### **Unit III**

Environment and energy. Energy sources – nuclear energy, fossil fuel energy and non-fossil and non-nuclear energy. Biomass energy – Composition of biomass-wastes as sources of renewable source of energy – Composition wastes – sources of wastes (Industrial, agricultural, forestry, municipal sources). Biomass conversion – non-biological process, direct combustion (Pyrolysis, Gasification, liquefaction); biological process (enzymatic digestion, anaerotic digestion, aerobic digestion). Bioenergy products – ethanol, biogas and Hydrogen. Bioremediation – microbial degradation of xenobiotics.

### **Unit IV**

**Concepts and Scope in Genetic Engineering:** Definition and outline strategy. Enzymology – Restrict enzymes, DNA ligases, reverse transcriptase, klenow fragment, Alkaline phosphatase, Polynucleotide kinase, terminal transferase, Dnase and Rnase. Cloning vehicles- Plasmids – pBR 322 & pUC; phage, cosmid, shuttle and YAC vectors. Gene cloning strategy – Isolation of foreign DNA and recombinant DNA construct – Transformation – Screening and Storage.Expression of cloned genes in prokaryotic and eukaryotic systems – minicell, maxicell, Fused and unfused gene expression.

### **Unit V**

Applications of Genetic engineering. Genetic engineering of plants – Development of crops for disease resistance, Salt tolerances, drought tolerance, herbicide tolerance and nutritional quality. Transgenic animals and its applications. Genetically

modified Microorganisms and its applications. Rules and regulation in biotechnology – biosafety, hazards of environmental engineering, and intellectual property right (IPR) and protection (IIP).

### **Text Books**

1. Kumar H.D., (1991). A text book on Biotechnology 2<sup>nd</sup> Ed, East-west Press Private Ltd., New Delhi. Pg.1-250; 411-472; 534-555.
2. Dubey R.C., 2001. A text book of Biotechnology 1<sup>st</sup> Edition. S.Chand & Company Ltd., New Delhi. Pg. 43-80; 113-197; 331-391.
3. Chhatoval G.R., 1995. Text book of Biotechnology, 1<sup>st</sup> Edi, Anmol Publications Pvt. Ltd., New Delhi.

### **References**

1. Demain, A.L., Solomon, N.A. (1986). "Manual of Industrial Microbiology and Biotechnology", ASM Press, Washington.
2. Dubey, R.C. (2001). A Text Book of Biotechnology .S. Chand & Company Ltd., Ramnagar, New Delhi.
3. Glick, B.R. and Pasternak, J.J (1994). Molecular Biotechnology, ASM Press, Washington DC.
4. Kumar, H.D. (1993). Molecular Biology & Biotechnology, Vikas Publishing House Pvt., Ltd., New Delhi.
5. Trevan, M.D, Boffey, S., Goulding, K.H. and Stanbury, P. (1990). Biotechnology- The basic Principles. Tata McGraw Hill, New Delhi.
6. Kumar, H.D. (1991) Biotechnology, 2nd Ed., East – West Press Private Ltd., New Delhi.

**UNIT 1**

Classification of protein – Based on source, shape, composition and solubility – carbohydrates – Monosaccharides, oligosaccharides and polysaccharides – Lipids – simple, compound and derived. Structure – protein – primary, secondary, Tertiary and quaternary – Carbohydrates and lipids – Properties – physical and chemical properties of protein, carbohydrate and lipids.

**Unit II**

Enzymes : Classification – Based on substrate acted upon by the enzyme, Type of reaction catalysed, substrate acted upon and type of reaction catalysed, substance that is synthesized, chemical composition of the enzyme substance hydrolysed and the group involved and over-all chemical reaction taken into consideration – six major classes of enzymes – oxidoreductases, Transferases, Hydrolases, Lyases, Isomerases and Ligases – Characteristics of enzymatic reaction (enzyme concentration, substrate concentration and Michaelis – Menten equation). Enzyme specificity and enzyme inhibitors.

**Unit III**

Nucleic acid structures – biological activities of Nucleic acids – synthesis – salvage and de novo pathway – Degradation – Regulation of nucleic acid metabolism – Replication of DNA – DNA polymerase in prokaryotes and eukaryotes – vitamins – Fat soluble and water soluble – structure, physiological role and disorders.

**Unit IV**

Introduction to metabolism – Catabolism and anabolism – Metabolic pathways – Carbohydrate metabolism – Glycolysis or EMP pathway, Pentose – Phosphate pathway, Krebs cycle (TCA cycle) Electron transport chain and oxidative phosphorylation – Biochemical importance and regulation.

**Unit V**

Lipid metabolism – Digestion and absorption of fatty acids – Oxidation and synthesis- Synthesis of triglycerides – Essential and Non-essential fatty acids – Amino acids- Essential and Non-essential – urea synthesis.

**References**

1. J.L. Jain 2003 Fundamental of Biochemistry S. Chand of company Ltd, New Delhi. Pp. 65-232; 277-234.

2. David L. Nelson and Michael M. Cox. 2003 Lehninger principles of Biochemistry, 3<sup>rd</sup> Edn. Mac Millan Worth publishers, New York, pp. 159 – 712
3. G.S. Sandhu 2002 Text book of biochemistry 18<sup>th</sup> Edn. Campus books International, New Delhi pp. 24-208.
4. A.C. Deb. 2000 Fundamentals of Biochemistry New Central book Agency, Ltd, Calcutta. Pp. 114-135; 179 – 209.
5. J.H. Well 1997. General biochemistry. 6<sup>th</sup> Edn. New Age International (P) Ltd Pub; New Delhi.
6. Ericc E.Conn, Paul K. Stumpf, George Bruening and Roy H. Doi 199+5. Outlines of Biochemistry. John Wiley of sons, New York. pp: 1 – 67

**Elective-1**

**MEDICAL BOTANY**

**Credits-4**

**Unit I**

Definition of medical terms, ecological habitats of medicinal plants of India, classification of medicinal plants; poisonous plants-classification, mode of action, symptoms and treatments, some poisonous plants of algae, fungi, lichens, pteridophytes, gymnosperms and angiosperms.

**Unit II**

Allergens-Introduction, aero-allergens, pollen, spore allergens, insect allergens, skin allergens, drug allergy and allergy therapy; remedial plants for cancer, common diseases of nervous system; circulatory system, respiratory system, urinary system and reproductive system, psycho active plants-introduction and mode of action.

**Unit III**

Pharmacognosy introduction, preparation of crude and commercial drugs; study about the botany, Chemical constituents, therapeutic uses of the following drugs.

Root drugs	- <i>Aconitum napellus</i>
Bark drugs	- <i>Cinchona officinalis</i>
Stem drugs	- <i>Aristolochia indica</i>
Leaf drugs	- <i>Digitalis purpurea</i>
Flower drugs	- <i>Eugenia caryophyllata</i>
Fruit drugs	- <i>Papaver somniferum</i>
Seed drugs	- <i>Nux vomica</i>
Entire organ	- <i>Cannabis sativa</i>
Unorganized drugs	- <i>Aloe vera</i>

**Unit IV**

Herbal gardens-introduction and scope, principles and process involved, plant growing methods, propagation techniques, guidelines for harvesting, processing and marketing of medicinal plants. Cultivation of medicinal plants. *Dioscoria floribunda* and *Papaver somniferum*

**Unit V**

Herbal home remedies of South India; preparation and usage of formulations: Infusions and decoctions, oil extractions, ointments, lotions, washes, suppositories.

**References**

1. Kumar, N.C. (1993) An Introduction to Medical Botany, Emkay Publications, New Delhi.
2. Nadkarani, 1981. Materia medica – Popular Prakasam Publication, New Delhi.
3. Jain, S.K. 1981. Glimpses of Ethnobotany. Oxford & IBH, New Delhi.
4. Hartman, H.T. & Kester, D.E. 1976. Plant Propagation, Principles and Practices, Prentice Hall – New Delhi.

**Unit I**

Introduction to mushroom biology: Mushroom past and present, characteristics, importance of mushrooms – as food, tonics and medicines.

**Unit II**

Basics of fungi as background for mushroom biology: Fungal characteristics, history of mycology, habitat, morphology, nutrition and reproduction of fungi.

**Unit III**

General principles of production of mushrooms and mushroom products: Contributing fields – microbiology, mycology and environmental engineering; phases of mushroom technology – pure culture, spawn, preparation of compost, mushroom development, management and marketing.

**Unit IV**

Mushroom biotechnology: Applications: Bioconversion of organics wastes into protein, fodder, soil conditioner and fertilizer, bioremediation, nutraceuticals, nutraceuticals, pharmaceuticals and medicinal properties.

**Unit V**

Prospects of tropical mushroom cultivation technology: Oyster mushroom technology, paddy mushroom technology, milky mushroom and button mushroom technology, post harvest technology. Mushroom farming and prospects.

**References**

1. Philip G. Miles, Shu-Ting Chang, 1997. Mushroom biology, World Scientific, Singapore.
2. Kaul, T.N. 1999. Introduction to mushroom science, Oxford & IBH Co., Pvt. Ltd., New Delhi.
3. Bahl, N. 1988. Handbook on mushrooms. Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi.

**Elective -3 HORTICULTURE, PLANT BREEDING & PLANT PATHOLOGY**  
**Credits - 4**

**Unit I**

**Horticulture**

Horticulture and its importance, Divisions of horticulture and significance ; Landscape gardening and Kitchen gardening- Planning, design, principles, basic components, pattern and significance; Growing plant indoor - terrarium, dish gardens, bonsai, hanging basket plants; Greenhouse; Phytohormones;Seedage, Cuttage, Layering and Graftage.

**Unit II**

**Vegetable and fruit culture**

Principles on Layout and preparation of beds; rotation and intercropping; crop management; cultivation of a vegetable crop-Tomato; Soil,planting details,pruning and shapping, manure and fertilizers and harvesting of a commercial orchard fruit crop-Mango.

**Unit III**

**Plant Breeding**

Plant breeding and its objectives, history; Outline of methods of crop improvement-selection, hybridization, plant introduction, mutation, breeding for disease resistance, hybrid vigour.

**Unit IV**

Hybridization-definition, objectives,techniques; Breeding work on wheat and Paddy - aims, distribution, botany and genetics, methods and new varities.

**Unit V**

**Plant Pathology**

Outline on types of plant diseases, causative agents; Disease resistance in plants-introduction, control of plant diseases;detailed study on downy mildew of grapes, loose smut of wheat, rust of wheat, blast disease of rice.

**References**

- 1) R. S. Shukla, P. S. Chandel, 2004., Cytogenetics Evolution and Plant Breeding S. Chand and Company Ltd. Ram Nagar, New Delhi.
- 2) M. K. Sadhu, 1996. Plant Propagation. New Age International (P) Ltd, Publishers. New Delhi, Bangalore, Calcutta.
- 3) K. Manibhushan Rao , 1995. Text book of Horticulture Rajiv Beri for Macmillan India Limited 2/10 Ansari Road, Daryagani , New Delhi – 110002.
- 4) Hudson T. Hartmann, Dale E. Kester, Fred T. Davies , JR. 1993. Plant propagation Principles and Practices . prentice - Hall of India Privated Limited, NewDelhi-110001.



**Elective-4**

**BIOFERTILIZERS AND BIOPESTICIDES**

**Credits-4**

**Unit I**

Biofertilizers: Definition - Types – Isolation, Authentication, Culture Characters and production of Rhizobium, Azotobacter, Azospirillum, Phosphobacteria, Vesicular Arbuscular Mycorrhizae, Blue green algae, Azolla, Frankia, and biomanure.

**Unit II**

Principles and methods of mass production of biofertilizers - Fermentation and other techniques.

**Unit- III**

Quality Control (BIS specification), marketing, evaluation of field performance and economics of production. Role of biofertilizer in integrated nutrient management.

**Unit- IV:**

Definition and History of Biopesticides – Viral (NPV, CPV & GV), bacterial (Bacillus thuringiensis, B. popilliae & Pseudomonas sp.), Fungal (Entomophthora musca, Beauveria sp., Metarrhizium sp. & Verticillium sp.) & Protozoan (Mattesia sp., Nosema sp., Octospora muscaedomesticae & Lambornella sp.).

**Unit –V:**

Microbial Pesticides – Advantages and disadvantages, Compatibility of microbial pesticides with synthetic pesticides, Microbial pesticides in integrated pest management – Necessity, Monitoring population of pests. Emerging technology – Genetic manipulations.

**Text Book**

1. Subba Rao, N. S. (1997). Biofertilizers in Agriculture and Forestry, III Ed., Oxford & IBH Publishing Co.Pvt.Ltd.,New Delhi.
2. Subba Rao, N. S. (1995). Soil Microorganisms and Plant growth Oxford & IBH Publishing Co.Pvt.Ltd.
3. Patel A.H. (1996). Industrial Microbiology, Macmillan India Limited,.

**References**

1. Allison, F.E. (1993). Soil Organic Matter and Its Role in Crop Production. Elsevier, Amsterdam.
2. Peters, G.A., Ito, O., Tyagi, V.V.S., Mayne, B.C., Kaplan, D. and Calvert, H.R. (1991). Photosynthesis and N<sub>2</sub> Fixation in the Azolla - Anabaena Symbiosis. In: Current Perspectives in Nitrogen Fixation, A.H. Gibson and W.E. Newton (Eds.). Australian Academy of Science, Canberra, pp: 121-24.
4. Singh, R.N. (1991). The Role of Blue- Green Algae in Nitrogen Economy

- of Indian Agriculture. Indian Council of Agricultural Research, New Delhi.
5. Venkataraman, G. S. (1992). Algal Biofertilizers and Rice Cultivation. Today & Tomorrow's Printers and Publishers, New Delhi.
  6. Patel, A.H. (1996). Industrial Microbiology, Macmillan India Ltd., New Delhi.
  7. Kumar H.D. (1991), Biotechnology, 2<sup>nd</sup> Ed., East-West Press Private Ltd., New Delhi.

**Elective-5**

**PLANT ECOLOGY**

**Credits-4**

**Unit I**

Climate, soil, vegetative patterns of the world, vegetation organization, community concepts, interspecific associations, ordination concept of ecological niche, vegetation development, changes in ecosystem properties during succession.

**Unit II**

Ecosystem organization, structure and functions, primary production, energy dynamics, global biogeochemical cycles of C, N, P and S mineral cycles in terrestrial and aquatic ecosystems.

**Unit III**

Biological diversity, concept and levels, role of biodiversity in ecosystem, functions and stability, speciation and extinction, IUCN, Categories of threat, terrestrial biodiversity hot spots, inventory.

**Unit IV**

Pollution, kinds, sources, quality parameters, effects on plants and ecosystems, climate change, green house gases consequences of climate change.

**Unit V**

Ecosystem stability, concept, natural and anthropogenic perturbations, their impact on plants and ecosystem, ecology of plant invasion, environmental impact assessment ecosystem, restoration, ecological management, sustainable development and sustainability indicators.

**References**

1. Smith, R.L. 1996. Ecology and Field Ecology, Harper Collins, New York.
2. Muller Dombosis, Dand Ellenberg, H. 1974, Aims and methods of vegetation Ecology, Wiley, New York.
3. Begon, M. Harper, J.L. and Townsend, C.R. 1996, Ecology, Backwell Science, Cambridge, USA.
4. Ludwig, J. and Reynolds, J.F. 1988. Statistical Ecology, John Wiley & Sons.
5. Odum, E.P. 1971, Fundamentals of Ecology, Saunders, Philadelphia.
6. Odum, E.P., 1983, Basic Ecology, Saunders, Philadelphia.