

**MANONMANIAM SUNDARANAR UNIVERSITY,
TIRUNELVELI**

PG - COURSES – AFFILIATED COLLEGES

Course Structure for M.Sc. Botany

(Choice Based Credit System)

(with effect from the academic year 2016- 2017 onwards)

(44th SCAA meeting held on 30.05.2016)

Sem	Sub 'Pr. No.	Subject status	Subject Title	Hrs/ week	Cre - dits	Marks				
						Maximum			Passing minimum	
						Int.	Ext.	Tot.	Ext.	Tot.
III	11	Core – 7	Taxonomy of Angiosperms and Economic Botany	6	5	25	75	100	38	50
	12	Core – 8	Biochemistry and Biophysics.	6	5	25	75	100	38	50
	13	Core – 9	Research methodology, Bioinstrumentation and Biological Techniques	6	5	25	75	100	38	50
	14	Elective- III	Computer Application and Bioinformatics (Major/ Non-Major)	6	5	25	75	100	38	50
	15	Practical	Core Practical 7,8 and 9	6	-	--	-	-	-	
IV	16	Core – 10	Plant Physiology and Metabolism	6	4	25	75	100	38	50
	17	Core – 11	Plant Ecology and Conservation Biology	6	4	25	75	100	38	50
	18	Core – 12	Applied Biotechnology	6	4	25	75	100	38	50
	19	Practical	Core Practical 7,8 and 9	--	4	50	50	100	25	50
	20	Practical	Core Practical 10,11,12	3	4	50	50	100	25	50
	21	Project	Project	3	5	50	50	100	25	50

Taxonomy of Angiosperms and Economic Botany

UNIT- I

Principles - Classification - (a) Artificial - Linnaeus (b) Natural -Bentham and Hooker (c) Phylogenetic - Cronquist and APG System.

Taxonomic hierarchy - Species concept - Binomial nomenclature: Principles of ICBN - Typification - Principles of Priority - Effective and Valid publication - Citation - Retention and Rejection of names. Herbarium preparation, major Indian and World Herbaria. Identification and preparation of keys and its significance.

UNIT- II

A detailed study with special reference to the following families:

Study of **Polypetalae families:** Magnoliaceae, Portulacaceae, Zygophyllaceae, Sapindaceae, Aizoaceae, Combretaceae, Lythraceae, and Cucurbitaceae.

Study of **Gamopetalae families:** Asclepiadaceae, Convolvulaceae, Pedaliaceae, Acanthaceae, Boraginaceae, Bignoniaceae, Scrophulariaceae, and Verbenaceae.

UNIT - III

Study of **Monochlamydeae families:** Euphorbiaceae, Amaranthaceae, Nyctaginaceae, Polygonaceae, Aristolochiaceae and **Monocotyledons:** Commelinaceae, Liliaceae, and Poaceae.

UNIT – IV

Modern Plant Systematics: Taxonomic evidences - from Morphology, Anatomy, Embryology, Photosynthetic types- C₃,C₄ Plants, Phytochemistry, serotaxonomy and Numerical taxonomy.

Molecular Systematics: Use of molecular markers and applications of RFLP, ISSR, SSR, ITS, and QTL. DNA Bar-coding. Digital / virtual herbaria.

UNIT – V

General account on **Economic Botany** - utilization of selected crop plants - Cereals- (Rice, Millets); Spices and Condiments - (Cardamom, *Piper*); Commercial crops - Fibre (Jute); Timbers (Teak, Red Sandal Wood); Resins and Gums (*Asafoetida*, Rubber); Fixed oils (*Sesamum*, Sunflower); Volatile oils - (Rosemary); Beverages (Tea, Coffee); Natural dyes (*Indigofera*, *Lawsonia inermis*) and Drug yielding plants (*Andrographis paniculata* and *Withania somnifera*).

Reference books:

- 1) Anonymous, (1948 -1976). *The Wealth of India*. 11 vols. NISCAIR (CSIR), New Delhi.
- 2) Ahmedullah, M., and M.P. Nayar. 1987. *Endemic Plants of the Indian Region*. Vol. I. Botanical Survey of India. Howrah.
- 3) Bell, A. D. (1991). *Plant form*. Oxford University Press, Oxford.
- 4) Cronquist, A. (1981). *An Integrated System of Classification of Flowering Plants*. Columbia University Press, New York.
- 5) Davis, P.H. and Heywood, V.H. 1973. *Principles of Angiosperms Taxonomy*. Robert E. Kreiger Pub. Co., New York.
- 6) Gamble, J.S., and C.E.C. Fischer. 1967. *Flora of the Presidency of Madras*. Vols. I - III. Botanical Survey of India. Calcutta.
- 7) Graham, L.E. 1993. *Origin of Land Plants*. John Wiley & Sons. Inc. New York.
- 8) Grant, W.F. 1984. *Plant Biosystematics*. Academic Press, London.
- 9) Greuter, W, (Ed.). 2000. *International Code of Botanical Nomenclature*. (St. Louis Code). Koeltz Vesentific Books. Germany.
- 10) Harrison, H.J.1971. *New Concepts in Flowering Plant Taxonomy*. Hieman Educational Books Ltd., London.
- 11) Henry,A.N., M.Chandrabose. 1980. *An Aid to International Code of Botanical Nomenclature*. Today & Tomorrow's Printers and Publishers. New Delhi.
- 12) Heywood, V.H. and Moore, D.M. 1984. *Current Concepts in Plant Taxonomy*. Academic Press, London.
- 13) Hooker, J. D. 1872 – 1897. *The Flora of British India*. 7 vols. (Rep. 2004) Bishen Singh Mahendra Pal Sigh, Dehra Dun.
- 14) Jain, S.K. and R.R. Rao. 1977. *A Handbook of Field and Herbarium Methods*. Today and Tomorrow's Printers and Publishers, New Delhi.
- 15) Jeffrey, C. 1982. *Introduction of Plant Taxonomy*, Cambridge University Press, Cambridge.
- 16) Judd, W. S, C. S. Campbell, E. A, Kellog, P. F. Stevens and N. J. Donoghue. 2008. *Plant Systematics – A phylogenetic approach*. 3rd edition. Sinauer Associates, Inc, Massachusetts, USA.
- 17) Kirtikar, K.R. and B.D. Basu I.C.S. *Indian Medicinal Plants*. Vol 1 -4. Bishen Singh Mahendra Pal Sigh, Dehradun, India.
- 18) Lawrence, G.H.M. 1951. *Taxonomy of Vascular Plants*. The Macmillan Company. New York.
- 19) Mabberley, D.J. 2008. *Plant-Book, A portable dictionary of plants, their classification and uses*. 3rd edition. Cambridge University Press, UK.
- 20) Moore, R., W.D. Clark, K.R. Stern and D. Vodopich. 1995. *Botany: Plant Diversity*. Wm. C. Brown Publishers. London.
- 21) Nadkarni, K.M. & A.K.Nadkarni. *Indian Materia Medica*. 1st Edition 1908, 3rd Edition 1954. Popular Prakashan, Bombay.

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- 22) Naik, V. N. 2000. *Taxonomy of Angiosperms*. Tata McGraw–Hill Publ Co. Ltd., New Delhi.
- 23) Nayar, M.P., 1996. "*Hot Spots*" of Endemic plants of India, Nepal and Bhutan. Tropical Botanic Garden and Research Institute, Thiruvananthapuram, India.
- 24) Nayar, M.P., And R.K. Sastry. 1987-1990. *Red Data Book on Indian Plants*. Vols. I - III. Botanical Survey of India. Howrah.
- 25) Nordenstam, B., El Gazaly, G. and Kassas, M.2000. *Plant Systematics for 21st Century*. Portlant Press Ltd., London.
- 26) Raven, P.H., R.F. Evert, and S.E. Eichhon. 1992. *Biology of Plants*. 5th Edition. Worth Publishers. New York.
- 27) Santapau, H. and H.A. Henry. 1994. *A dictionary of the flowering plants in India*, CSRI, New Delhi.
- 28) Simpson, M. G. 2010. *Plant Systematics*. Elsevier Academic Press, California, USA.
- 29) Subramaniam, N.S.1995. *Modern Plant Taxonomy*. Vikas Publishing House. New Delhi.
- 30) Sivarajan, V.V. 1996. *Introduction to the Principles of Plant Taxonomy*. Oxford & IBH Publishing Company Ltd., New Delhi.
- 31) Stuessy, T. F. (1990). *Plant taxonomy - the systematic evaluation of comparative data*. Columbia Univ. Press, Columbia.
- 32) Takhtajan, A. 1997. *Diversity and Classification of Flowering Plants*. Bishen Singh and Mahendrapal Singh, Dehra Dun, India.
- 33) UNEP (1995). *Global Biodiversity Assessment*. Cambridge University Press, London.
- 34) Warriar, P.K., Nambiar, VPK & C. Ramankutty (Eds.).1993-1996..*Indian Medicinal Plants: A compendium of 500 species*. Vols.1-5. Orient BlackSwan / Universities Press. Hyderabad.

Biochemistry and Biophysics

UNIT -I

Biomolecules: Carbohydrates - properties of mono, oligo and polysaccharides. Structure and functions of trioses, tetroses, pentoses, hexoses, maltose, sucrose, starch and pectin-glycosidic linkage, isomerism and mutarotation. Deoxy sugars, glycoproteins, amino sugars.

UNIT- II

Amino acids and proteins, ionic forms of amino acids. General reactions of amino acid metabolism. Zwitterion, isoelectric pH, optical isomers of amino acids and physical properties of amino acids.

Formation of peptide bond - peptides - structure of polypeptides primary, secondary, tertiary and quaternary protein structure - super secondary structures. Ramachandran plot - denaturation of proteins.

UNIT – III

Lipids - Classification, structure and properties - Fatty acids - saturated and unsaturated fatty acids - Structure of fatty acids and glycerol -phospholipids, glycolipids, steroids. Biosynthesis and Oxidation of fatty acid - Glyoxalate pathway - Gluconeogenesis.

UNIT - IV

Enzymes - Properties - Cofactors, metallic activators, coenzymes. Nomenclature and Classification - Enzyme kinetics - Concept of active sites Michaelis-Menton constant - mechanism of enzyme action - enzyme inhibitors - competitive and non-competitive, allosteric control of enzymes. Enzyme regulation.

UNIT – V

Properties of light - Different components of electromagnetic radiation. Emission - Excitation - Fluorescence and Phosphorescence - Bioluminescence. Laws of Thermodynamics, Redox potential, dissociation and association constant, activation energy, binding energy. High energy compounds in biology and their significance.

Reference Books

1. Adams, R.L.P, Burdon, R.H., Campbell, A.M., Leader, D.P. and Smile, R.M.S. 1981. The biochemistry of Nucleic acids. Chapman and Hall Ltd. New York.
2. Agarwal, O.P. 1989. Chemistry of organic natural products. Goel Publishing House, New Delhi.
3. Bonner and Varner, 1976. Plant Biochemistry. Academic Press. NewYork.
4. Deb, A.C. 2011. Fundamentals of Biochemistry. New Central Book Agency (P) Ltd., Kolkatta.
5. Conn and Stumpt, 1987. Outlines of Biochemistry. John Wiley and Sons, NewYork.
6. Jain, J.L. 2005. Fundamantals of Biochemistry. S. Chand and Company, New Delhi.
7. Jayaraman, J. 1895. Laboratory Manual in Biochemistry, Wiley Eastern Limited, New Delhi.
8. Plummer, D.T. 1990. An introduction to Practical Biochemistry. Tata Mc Graw Hill publishing Company, New Delhi.
9. Stryer, 1986. Biochemistry. CBS Publishers and Distributors, New Delhi.
10. Satyanarayana, U. 2005. Biochemistry. Books and Allied (P) ltd, Kolkatta.
11. Palanichamy and Shanmugavelu, M. 1996. Principles of Biophysics. Palni Paramount Publications.
12. Narayanan, P. 2008. Essentials of Biophysics. New Age International Publishers, New Delhi.

Research Methodology, Bioinstrumentation and Biological Techniques

UNIT - I

Research Methodology: Choosing the problem for research - Review of Literature - Primary, Secondary and Tertiary sources - Bibliographs - Indexing and abstracting - Reporting the results of research in conference - Oral and Poster presentation. Planning and preparation of thesis. Research journals, Editing & Proof correction, Abstract writing and keywords selection, Full paper, Short Communication, Monographs, Review Articles. Reference collections, Citation, Thesis format, Journal formats. Impact Factor, Style Manuals.

UNIT- II

Biostatistics: Scope, Collection and classification of data, Tabulation, Graphical and diagrammatic representation, Histograms. Probability analysis, Mean, Median, Mode. Students - t - test, ANOVA - Application softwares - SPSS.

UNIT – III

Microscopy - Principles and application - Light - Dark field - Phase contrast - Fluorescence - Polarization - Scanning and Transmission Electron Microscopy, Photomicrography.

Cytochemical and histochemical methods- Microtomes: rotary, wood and cryo types. Microtome techniques: dehydration, clearing, fixation, embedding, staining, mounting, sectioning. Cytochemistry and detection of nucleic acids, carbohydrates, proteins and lipids.

UNIT - IV

Centrifugation: High speed, and Ultra centrifuges.

Spectroscopy: Flame photometer; UV-Vis Spectrophotometer, AAS, FTIR, NMR, Fluorescence, Mass, and Raman Spectroscopy.

Chromatography: Theory, principles and applications of Paper, TLC, gel filtration, ion exchange, affinity, GC, HPTLC and GCMS.

UNIT -V

Electrophoresis: Basic principles, theory and applications of starch gel, agarose, native and denaturing PAGE, isoelectric focusing.

Radiolabelling techniques: Handling of Radioisotopes in labs, Dosimetry, Ionization chamber, GM counter, Solid and liquid scintillation counters, Autoradiography. Radio ImmunoAssay.

Introduction to Nanoscience and Nanobiology methods.

Books for References:

- 1) Daniel WW, 1995. Biostatistics. 7th edition, John Wiley and Sons, New York, USA.
- 2) Bliss CI, 1970. Statistics in Biology. Vol I and II, Mc Graw-Hill Inc. USA.
- 3) Green, M. R. and Sambrook, J. 2012. *Molecular Cloning: A Laboratory Manual*. 4th Edition, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.
- 4) Khan, I.A. and Khanum, A. 1994. *Biostatistics*. Vikas Publishing House Pvt. Ltd. New Delhi.
- 5) Panse, V.G. and Sukhatme, P.V. 1967. *Statistical Methods for Agricultural Workers*. ICAR, New Delhi.
- 6) Plummer, D.T. 1988. *An Introduction to Practical Biochemistry*. Tata McGraw Hill Publishing Company. New Delhi.
- 7) Raghuvanshi. 1995. *Practical Exercises in Cytology, Genetics, Plant Breeding and Biostatistics*. CBS Publishers & Distributors, New Delhi.
- 8) Sandhu, G.S. 1990. *Research Techniques in Biological Sciences*. 1st Edition. Anmol Publications, New Delhi.
- 9) Steel, R.G.D. and Torrie, J.H. 1960. *Principles and Procedures of Statistics with special reference to Biological Sciences*. McGraw-Hill.
- 10) Wilson, K. and Walker, J. 2000. *Principles and Techniques of Practical Biochemistry*. Cambridge University Press, London.
- 11) Balagurusamy, E. 2009. *Fundamentals of Computers*. Tata McGraw-Hill Education Pvt. Ltd., New Delhi.
- 12) Rajaraman, V. *Introduction to Information Technology*. PHI. New Delhi.

Computer Application and Bioinformatics

UNIT - I

Computer - Definition, Need for computers, Characteristics of computer. Classification of computers - organisation to computer - detail of input units, output units, central processing unit. Peripheral and storage devices. Knowledge about windows and its scientific applications - MS Word, Power Point, Excel.

UNIT - II

Internet - world wide web - Internet protocols - Internet Browsers - Search Engines - HTML - e-mail - e-books and e-journals - Retrieval of information from Internet - Applications of Internet.

UNIT - III

Introduction to Bioinformatics - Definition, Need, Development and Potential of Bioinformatics - Genomics and Proteomics - Human Genome Project and medically relevant genes - Pharmacoinformatics - Cheminformatics.

UNIT - IV

Bioinformatics Databases: Nucleic acid sequence Databases - GenBank, EMBL, DDBJ. Protein Sequence Databases - SwissProt, TrEMBL. Structure Databases - PDB, CATH, CSD. Taxonomic Databases - GRIN, ILDIS, IPNI, Kew. Literature Databases - PubMed, MedLine, Scopus.

UNIT - V

Techniques in Bioinformatics: FASTA - BLAST - Types. Pairwise and Multiple Sequence Alignment methods. DNA sequence analysis - Open Reading Frame - Microarray Applications. Molecular Visualisation - JS Mol / RasMol. Prediction of Activity Spectra - PASS.

Books for Reference

1. Alexis Leon and Mathews Leon, 2013. *Computer Applications in Business*, Vijay Nicole Imprints, Chennai.
2. Bryan Bergeron, 2006. *Bioinformatics Computing*, Prentice Hall of India, New Delhi.
3. Gautham N., *Bioinformatics - Databases and Algorithms*, Narosa Publishing House, Chennai.
4. Ignacimuthu, S., 2012. *Basic Bioinformatics*, Narosa Publishing House. New Delhi.
5. Mohan P., 2009. *Fundamentals of Computers*, Himalaya Publishing House, New Delhi.
6. Narayanan, P., 2005. *Bioinformatics - A Primer*, New Age International Publishers, New Delhi.
7. Neeru Mundra Renu Vashisth, 2011. *Introduction to Information Technology*, Himalaya Publishing House, New Delhi.
8. Rastogi, S.C., Mandiratta Namita and Rastogi Parag, 2003. *Bioinformatics - Concepts, Skill Applications*, CBS Publications.
9. Ravishankar S. and Raphael P.V., 2004. *Computer Awareness and Applications*, Himalaya Publishing House, New Delhi.
10. Saxeena Sanjay, 2002. *MS office for everyone*, Vikas Publishing House, New Delhi.

11. Teresa K. Attwood and David J. Parry-Smith, 2006. *Introduction to Bioinformatics* Dorling Kindersley Pvt. Ltd. India.

Suggested Reading:

1. Alexis Leon and Mathews Leon, 2013. *Computer Applications in Business*, Vijay Nicole Imprints, Chennai.
2. Gautham N., *Bioinformatics - Databases and Algorithms*, Narosa Publishing House, Chennai.
3. Narayanan, P., 2005. *Bioinformatics - A Primer*, New Age International Publishers, New Delhi.
4. Teresa K. Attwood and David J. Parry-Smith, 2006. *Introduction to Bioinformatics* Dorling Kindersley Pvt. Ltd. India

Taxonomy of Angiosperms and Economic Botany

Practical

1. Identification of plants mentioned in the syllabus.
2. Preparation of dichotomous key.
3. Identification of Binomial using flora (J.S. Gamble).
4. Technical description of plants from locally available plants.
5. Dissection of floral parts.
6. A study tour of Taxonomic interest (any area) – Submission of an album with 20 photographs of plant specimens from the prescribed families and field note book. .
7. Spotters for Economic Botany - to know the family, binomials of economically important plants, their parts and economic importance.

Biochemistry and Biophysics

Practical

1. Determination of neutralization point of acid- base mixture by titration method using pH meter.
2. Estimation of sugars by anthrone method - Colorimetrically /Spectrophotometer.
3. Estimation of aminoacids by ninhydrin method colorimetrically / Spectrophotometer.
4. Estimation of proteins (Lowry's method / Bradford method).
5. Extraction and separation of known and unknown amino acids by using Paper Chromatography method.
6. Determination of saponification value of any two vegetable oils.
7. Determination of Km value of Nitrate Reductase enzyme.

Research Methodology, Bioinstrumentation and Biological Techniques

Practical

1. Demonstration of microscopes (Light and Dark field, phase-contrast, fluorescence, SEM, TEM).
2. Demonstration of centrifugation (Ultra, high speed and cryo).
3. Verification of Beer-Lambert Law using spectrophotometry.
4. Demonstration of TLC, UV-Vis Spectrophotometer, Flame photometer, and MASS spectrophotometer.
5. Separation of plant proteins using SDS-PAGE, and DNA by AGE.
6. Demonstration Microtomy: preparation of thin sections and permanent slides.
7. Micrometry: Principle and measurement of microscopic objects: Low power and high power.
8. Histochemical localisation of soluble components in plant cells - proteins, sugars, polysaccharides, lipids, nucleic acids, tannins, phenols, etc.
9. Demonstration of statistics software to analyse field data.
10. Knowledge of Bioinstruments and Biological techniques
11. Problems from Biostatistics – SD & SE , T – test and X^2

Plant Physiology and Metabolism

UNIT –I

Water and Plant relations: Cell water relations, mechanism of water uptake - Concept of Apoplast and Symplast. Absorption and transport of solutes (Passive and Active). Translocation of organic solutes. Phloem loading and unloading. Importance of macro and micronutrients. Transpiration - Mechanism of stomatal movement - starch-sugar interconversion theory and K⁺ ion transport and stomatal regulation.

UNIT - II

Photosynthesis - Photosynthetic pigments - Light harvesting complexes PS I and PS II. Photo oxidation of water. Mechanisms of electron and proton flow through photosynthetic transport chain - Z Scheme. Photo phosphorylation and mechanism of ATP synthesis. C₃, C₄ and CAM pathways. Photorespiration and its significance.

UNIT - III

Plant Respiration: Glycolysis, Citric acid cycle and Mitochondrial electron transport - Oxidative phosphorylation and terminal oxidation - cyanide resistant pathway - Beta oxidation - Glyoxylate Cycle.

Nitrogen metabolism - Biological nitrogen - Mechanisms of Nitrate uptake and reduction - ammonia assimilation.

UNIT - IV

Growth and development - Relative, Net and Sigmoid Growth Rate. Physiological role and mechanism of action of auxins, gibberellins, cytokinins, ethylene and abscissic acid. Growth retardants - Morphactins and Brassinosteroids.

Photoperiodism and Vernalizations - flower induction and development. Phytochrome - structure, properties and physiological role. Movements - Nastic and tropic movements. Senescence and Abscission - physiological and biochemical changes. Seed dormancy - Physiology of seed germination.

UNIT - V

Stress physiology - classification of stress - biotic and abiotic stress factors. Stress effects - morphological, biochemical, physiological changes associated with stress due to salinity, water, radiation, heavy metals, drought, freezing and heat. Heat shock proteins - Stress resistance mechanisms.

Reference Books.

1. Bidwell, R.G.S. 1980. Plant physiology Academic Press, New York.
2. Datt, S.C. 1989. Plant physiology central Book Depot. Allahabad - 48.
3. Devlin, R.M. 1990 Plant physiology Reinhold Publishers corp. Newyork.
4. Govindji, 1982. Photosynthesis. A.P. Newyork.
5. Salisbury, F.B and Ross, C. 2000. Plant Physiology. John Wiley & sons New Delhi.
6. Sinha, R.K. 2004. Modern Plant physiology. Narosa publishing House New Delhi.
7. Verma, V. 2007. A text Book of plant physiology. Ane Books, New Delhi
8. Noggle, G.R and Fritz, G.J. 2010. Introductory plant physiology. PHI learning Pvt. Ltd. New Delhi.
9. Jacob, W.P. 1979. Plant Hormones and plant Development.

Plant Ecology and Conservation Biology

UNIT- I Aim and scope of Ecology - Autecology and Synecology - Qualitative and Quantitative characters of community. Niche - definition and types. Methods of studying plant community.

Ecosystem: Types - Terrestrial Forest and Crop land ecosystem - Aquatic ecosystems - fresh water, marine, estuarine and mangroves with special reference to trophic structures - Major biomes of the world.

UNIT - II Ecological amplitude of a species and adaptation - Ecads, ecotypes, ecospecies, Raunkaier's Life Forms. Succession - causes, patterns of succession - xeroseres and hydroseres. Types of forests.

Energy resources: utilization - Renewable and Non-renewable energy resources. Earth summits- Kyoto protocol - Environmental Laws and Education.

UNIT - III Environmental pollution - Air, water, soil, thermal and radiation. Causes, consequences and control of pollution on Global environment, Ozone depletion, Greenhouse effect. Climate change and Global Warming. Ecological impact of pollution - soil erosion, deforestation. Disaster management - Floods, Earth quake, Cyclones, Tsunami and Landslides.

UNIT - IV Biodiversity - definition, scope and constraints, Levels of biodiversity (genetic, species and ecosystem), measures of biodiversity, values and use of biodiversity, loss of biodiversity, threats to biodiversity.

Phytogeography: Range - Dispersal and migration barriers hypothesis, Continental drift hypothesis, Land - Bridges hypothesis, Age and Area hypothesis, Endemism - Red Data Book. Continuous and discontinuous distribution of vegetation. Introduction to Remote Sensing and GIS.

UNIT - V Conservation Biology: current practices in conservation - Ecosystem approaches - Species based approaches–Social approaches - Chipko Movement, Narmada Bacho Andolan. *In situ* conservation (Protected area, Afforestation, Social Forestry, Agro Forestry, Biosphere Reserves, National Parks, Sanctuaries, Sacred Groves and Sthalavrikshas) and *ex situ* conservation (Botanical Gardens, Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, DNA Banks. Tissue Culture and Biotechnological strategies of conservation. Role of organizations in Biodiversity management - IUCN, BSI and FAO.

Reference Books

1. Ignacimuthu, S. 2013. Environmental studies. MJP Publishers, India.
2. Agrawal, K.C. 1987. Environmental Biology. Agro-botanical Publications, India.
3. Ambasht, R. S. 1974. A Textbook of Plant Ecology. 3rd ed. Students' Friends Co. Varanasi, India.
4. Billings, W. B. 1965. Plants and the Ecosystem. Wardsworth Publishing Co. Inc., Belmont.
5. Kershaw, K. A. 1973. Quantitative and Dynamic Plant Ecology. Edward Arnold Publishers Ltd., London.
6. Kormandy, E. J. 1978. Concepts of Ecology. 2nd ed. Prentice Hall of India Pvt. Ltd., New Delhi.

7. Krishnan Kannan, 1997. Fundamentals of Environmental Pollution. S. Chand and Co. Ltd., New Delhi.
8. Levitt, J. 1980. Responses of Plants to Environmental Stresses. Acad. Press, New York.
9. Odum, E. P. 1971. Fundamentals of Ecology. W. B. Saunders & Co., Philadelphia, USA.
10. Odum, E. P. 1975. Ecology. 2nd ed. Oxford & IBH Publications, New Delhi.
11. Puri, G. S. 1960. Indian Forest Ecology. Vol. I & II. Oxford & IBH Publications, Delhi.
12. Vashista, P. C. 1974. A Textbook of Plant Ecology. Vishal Publications, Jullunder.
13. Cain, S. A. 1944. Foundation of Plant Geography. Harper & Brothers, New York.
14. Good, R. 1953. The Geography of Flowering Plants. 2nd ed. Longmans Green & Co. Inc., London.
15. Mani, M. S. 1974. Ecology and Biogeography of India. Dr. W. Junk Publishers, the Haque.
16. Frankel, O. H., Brown, A. H. D. and Burdon, J. J. 1995. The Conservation of Plant Diversity. Cambridge University Press, London.
17. Heywood, V. H. 1995. Global Biodiversity Assessment. UNEP, Cambridge University Press, London.

Applied Biotechnology

UNIT - I

Biotechnology - scope and potentialities. Tissue Culture: Single cell and suspension culture, Organ culture - Meristem, Embryo and anther culture. Production of haploids, detection and identification, and uses of haploids. Micropropagation - virus elimination, secondary metabolite production, haploids, triploids, encapsulated seeds - Application of plant tissue culture in agriculture and crop improvement.

UNIT - II

Outline of Genetic engineering - transposons as vectors - gene cloning - cloning in eukaryotes. Promoters and terminators - *Agrobacterium* derived promoters - 35S promoters of CaMV, inducible and tissue specific promoters. Importance of promoters. Amplification of genes by PCR. Gene transfer methods in plants - vectors - Ti and Ri plasmids of *Agrobacterium*, Physical delivery methods.

UNIT - III

Transgenic plants resistant to Pest, Insects and Herbicides - Transgenic plants with improved quality traits - Flavr Savr tomato, Golden rice. Improved varieties in Floriculture. Transgenic plants for molecular pharming. Edible vaccines. Genetically engineered Humulin.

UNIT - IV

Biotechnology for pollution abatement - Anaerobic biological treatment - Treatment of organic and inorganic wastes - Biorecovery of metals. Biosensors - Bioremediation methods - *In situ* and *ex situ* bioremediation - Biomining - Bioleaching.

Enzyme technology - large scale production of fungal enzymes -extraction and purification methods involved - application of fungal enzymes in different industries.

UNIT - V

Bio-fuels from all kinds of plants. Biodegradable plastics. Biotechnology and healthcare - Gene therapy - types, methods and applications. Production of antibodies, vaccines and monoclonal antibodies - applications.

Reference Books

1. Chawla, H.S. 2002. Introduction to Biotechnology. Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.
2. Razdan, M.K. 2003. An Introduction to Plant Tissue Culture. Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.
3. Dubey, R.C. 2006. Text Book of Biotechnology. S. Chand and Company Ltd.
4. Satyanarayana, U. 2008. Biotechnology. Books and Allied (P) Ltd, Kolkata.
5. Das, H.K. 2005. Text book of Biotechnology. Wiley Dream tech India Pvt. Ltd., Delhi.
6. Slater, A., N.W. Scott, and Flower, M.R. 2010. Plant Biotechnology: The genetic manipulation of plants. Second edition, Oxford University Press.

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5. Separation of plant proteins using SDS-PAGE, and DNA by AGE.
6. Demonstration Microtomy: preparation of thin sections and permanent slides.
7. Micrometry: Principle and measurement of microscopic objects: Low power and high power.
8. Histochemical localisation of soluble components in plant cells - proteins, sugars, polysaccharides, lipids, nucleic acids, tannins, phenols, etc.
9. Demonstration of statistics software to analyse field data.
10. Knowledge of Bioinstruments and Biological techniques
11. Problems from Biostatistics – SD & SE , T – test and X^2

Plant Physiology and Metabolism

Practicals.

1. Determination of water potential by gravimetric method.
2. Measurement of photosynthesis - Hill activity (Time course).
3. Estimation of photosynthetic pigments with reference to age (Two stages).
4. To determine the Chl a / Chl b ratio in C₃ and C₄ plants.
5. Estimation of Proline in normal and stressed leaves.
6. Effect of pH, temperature and detergents on membrane permeability.
7. Extraction and separation of seed proteins.
8. Estimation of anthocyanins using colorimeter/Spectrophotometer.

Plant Ecology and Conservation Biology

Practicals.

1. Vegetation Analysis (Quadrats and line transects) - Raunkaier's frequency diagram dominance and density in a given area and Shannon - Weaver's measures of species diversity index.
2. Water analysis - Dissolved oxygen - Alkalinity - Carbonate and bicarbonate. Water hardness - Calcium and Magnesium, Chemical Oxygen Demand and Primary productivity (Winkler's method).
3. Estimation of organic matter in the soil by Walkley Black method.

Study of the following:

Field visit: Student may visit ecologically important Locations.

- I. Interpretations
 1. Climatic zones of our country.
 2. Vegetation types of India.
 3. Floral Kingdoms.
 4. Discontinuous distribution.
 5. Endemism.

Applied Biotechnology

Practicals:

1. Preparation of MS medium.
2. Demonstration of *in vitro* sterilization and inoculation methods using leaf and nodal explants of Tobacco, *Datura*, *Brassica*.
4. Study of Anther, Embryo and Endosperm culture, Micropropagation, Somatic embryogenesis and artificial seeds
5. Study of methods of gene transfer. Isolation of Plasmid DNA, Restriction digestion and gel electrophoresis of plasmid DNA, *Agrobacterium* - mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
7. Study of steps of genetic engineering for production of Bt cotton, Golden rice.
8. Production of biofuels from algae, Mass cultivation of algae, *Spirulina*- SCP production.
9. Compulsory visit to institution(s) related in the field of Biotechnology

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