MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI

PG - COURSES – AFFILIATED COLLEGES

Course Structure for M.Sc. Botany

(Choice Based Credit System)

(with effect from the academic year 2017- 2018 onwards)

Sem. (1)	Sub. No. (2)	Subject Status (3)	Subject Title (4)	Contact Hrs./ Week (5)	Credits (6)
III	14	Core - 14	Taxonomy of Angiosperms and Economic Botany	6	4
	15	Core - 15	Biochemistry and Biophysics	6	4
	16	Core - 16	Computer Applications and Bioinformatics	5	4
	17	Core - 17	Research Methodology, Bioinstrumentation and Biological techniques	5	4
	18	Core - 18 Practical - 5	Taxonomy of Angiosperms, Economic Botany, Research Methodology, Bioinstrumentation and Biological techniques	4	2
	19	Core - 19 Practical - 6	Biochemistry, Biophysics, Computer Applications and Bioinformatics	4	2
			Subtotal	**30**	**20**
IV	20	Core - 20	Plant Physiology	4	4
	21	Core - 21	Plant Ecology and Conservation Biology	4	4
	22	Core - 22	Applied Biotechnology	4	4
	23	Core - 23 Practical - 7	Plant Physiology and Applied Biotechnology	4	2
	24	Core - 24 Practical - 8	Plant Ecology and Conservation Biology	4	2
	25	Elective - 1	Medicinal Botany and Dietetics	3+	3
	26	Core - 25	Project	7+	8
			Subtotal	**30**	**27**
Total				**120**	**90**

+ Extra hours for the Project

For the Project, flexible credits are b/w 5 – 8 & Hours per week are b/w 10 - 16.

Total number of credits ≥ 90	**:**	**90**
Total number of Core Courses	**:**	**25 (15 T + 8 P + 1 Prj. + 1 FW.)**
Total number of Elective Courses / F.W. / S.T.	**:**	**1**
Total hours	**:**	**120**

Taxonomy of Angiosperms and Economic Botany

L	T	P	C
2	4	0	4

Prerequisite:

Basic knowledge in Plant Morphology and Taxonomy gained from Undergraduate programme

Objectives:

- To learn about identification and classification of plants
- To learn about preparation of herbarium and molecular Plant Systematics
- To understand the economic importance of plants in day to day life

Outcome:

- Graduates will easily identify common and economically important plants
- Acquisition of knowledge about conservation of economically important plants
- Herbal remedy knowledge acquisition

Taxonomy of Angiosperms and Economic Botany

UNIT- I

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

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

L	T	P
8	14	0

(22 Hrs.)

UNIT- II

A detailed study with special reference to the following families:

Study of P**olypetalae families:** Magnoliaceae, Zygophyllaceae, Sapindaceae, Combretaceae, Lythraceae, and Cucurbitaceae.

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

L	T	P
7	12	0

(19Hrs.)

UNIT - III

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

L	T	P
4	8	0

(12Hrs.)

UNIT – IV

Modern Plant Systematics: Taxonomic evidences - from Morphology, Anatomy, Embryology, Chemotaxonomy. Digital / Virtual herbaria.

Molecular Systematics: Use of molecular markers and applications of RFLP, ISSR, DNA Bar-coding.

L	T	P
4	12	0

(16 Hrs.)

UNIT – V

General account on **Economic Botany** - Utilization of selected crop plants - Cereals- (Rice, Millets - Ragi); Spices and Condiments - (Cardamom, Pepper); Commercial crops - Fibre (Jute); Timbers (Teak, Red Sander); Resins and Gums (Asaefoetida, Gum Arabic); Fixed oils (Gingelly, Sunflower); Volatile oils - (Rosemary); Beverages (Tea, Coffee); Natural dyes (Indigo, Henna) and Drug Yielding Plants (Nilavembu and Indian Ginseng)

L	T	P
7	14	0

(21 Hrs.)

(Total: 90Hrs.)

Text books:

1. N.S.Subramaniam, *Modern Plant Taxonomy*. Vikas Publishing House. New Delhi, 1995.
2. N. V. Naik, *Taxonomy of Angiosperms*. Tata McGraw–Hill Publ Co. Ltd., New Delhi, 2000.

Reference books:

1. M.Ahmedullah and M.P. Nayar. Endemic Plants of the Indian Region. Vol. I. Botanical Survey of India. Howrah, 1987.
2. A. Cronquist, An Integrated System of Classification of Flowering Plants. Columbia University Press, New York, 1981.
3. P.H. Davis, and V.H. Heywood, *Principles of Angiosperms Taxonomy*. Robert E. Kreiger Pub. Co., New York, 1973.

4. J.S. Gamble, and C.E.C. Fischer. Flora of the Presidency of Madras. Vols. I - III. Botanical Survey of India. Calcutta, 1967.
5. H.J. Harrison, New Concepts in Flowering Plant Taxonomy. Hieman Educational Books Ltd., London, 1971.
6. A.N. Henry and M. Chandrabose. An Aid to International Code of Botanical Nomenclature. Today & Tomorrow's Printers and Publishers. New Delhi, 1980.
7. Heywood, V.H. and Moore, D.M. Current Concepts in Plant Taxonomy. Academic Press, London, 1984.
8. C. Jeffrey, Introduction of Plant Taxonomy, Cambridge University Press, Cambridge, 1982.
9. G.H.M. Lawrence, Taxonomy of Vascular Plants. The Macmillan Company. New York, 1951.
10. M.P. Nayar, "Hot Spots" of Endemic plants of India, Nepal and Bhutan. Tropical Botanic Garden and Research Institute, Thiruvananthapuram, India, 1996.
11. M. G. Simpson, Plant Systematics. Elsevier Academic Press, California, USA, 2010.
12. V.V. Sivarajan, Introduction to the Principles of Plant Taxonomy. Oxford & IBH Publishing Company Ltd., New Delhi, 1996.

Practicals

1. Identification of plant species included in the syllabus.
2. Preparation of dichotomous key.
3. Identification of Binomial using flora (J.S. Gamble).
4. Dissection and technical description of plant species from any locally available plants.
5. A study tour of Taxonomic interest (any area) – Submission of an album with 10 photographs and 10 herbarium plant specimens from the prescribed families with a field note book.
6. Spotters for Economic Botany - to know the family, binomials of economically important plants, their parts and economic importance.

Biochemistry and Biophysics

L	T	P	C
2	4	0	4

Prerequisite:

Basic knowledge on structure and role of biomolecules - gained from undergraduate programme

Objectives:

- To gain advanced knowledge about plant biomolecules
- To understand different metabolic pathways occurring in a cell
- To provide an advanced integral knowledge and understanding of topics in Biochemistry and Biophysics

Outcome:

- Acquisition of analytical and presentational skills
- Graduates will have a solid foundation and in-depth understanding of current topics in Biochemistry
- knowledge gained about biofluorescent and bioluminescent compounds could be used in as molecular reporters in medical field

UNIT -I

Biochemistry and Biophysics

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

L	T	P
8	12	0

(20 Hrs.)

UNIT- II

Amino acids and proteins, ionic forms of amino acids. 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**.**

L	T	P
6	12	0

(18 Hrs.)

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 - Gluconeogenesis.

L	T	P
5	10	0

(15 Hrs.)

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**.**

L	T	P
5	14	0

(19 Hrs.)

UNIT – V

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

L	T	P
6	12	0

(18 Hrs.)

(Total : 90Hrs.)

Text books:

1. J.L. Jain, Fundamantals of Biochemistry. S. Chand and Company, New Delhi, 2005.
2. U. Satyanarayana, Biochemistry. Books and Allied (P) ltd, Kolkatta, 2005.

Reference Books

1. R.L.P. Adams, Burdon, R.H., Campbell, A.M., Leader, D.P. and Smile, R.M.S. The
2. Biochemistry of Nucleic acids. Chapman and Hall Ltd. New York,1981.
3. O.P. Agarwal, Chemistry of organic natural products. Goel Publishing House, New Delhi, 1989.
4. J. Bonner and J. E. Varner, Plant Biochemistry. Academic Press, NewYork, 1976.
5. A.C. Deb, Fundamentals of Biochemistry. New Central Book Agency (P) Ltd., Kolkatta, 2011.
6. E.E. Conn and P.K. Stumpf, Outlines of Biochemistry. John Wiley and Sons, NewYork, 1987.

7. J. Jayaraman, Laboratory Manual in Biochemistry, Wiley Eastern Limited, New Delhi,1895.
8. D.T. Plummer, An introduction to Practical Biochemistry. Tata Mc Graw Hill publishing
9. Company, New Delhi, 1990.
10. J. M. Berg, J. L. Tymoczko and L. Stryer Biochemistry, W.H. Freeman Company, New York, 2012.
11. S. Palanichamy and M. Shanmugavelu, Principles of Biophysics. Palani Paramount Publications. 1996.
12. P.Narayanan, Essentials of Biophysics. New Age International Publishers, New Delhi, 2008.

Practicals

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

Computer Application and Bioinformatics

L	T	P	C
3	2	0	4

Prerequisite:

Basic knowledge in Computer Operation

Objectives:

- To learn the basic applications of computer and internet
- To gain a working knowledge on computer and search strategies
- to understand the scope and application of bioinformatics

Outcome:

- Acquisition of working knowledge on computer and surfing the web
- Accumulation of knowledge in genomics and proteomics.
- Acquisition of skill in molecular docking and drug designing.
- Graduates will be able to use online databases

Computer Application and Bioinformatics

UNIT - I

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

L	T	P
10	4	0

(14 Hrs.)

UNIT - II

Internet - world wide web - Internet protocols - Internet Browsers - Search Engines - e-books e-journals and e-mail. Applications of internet.

L	T	P
8	5	0

(13 Hrs.)

UNIT - III

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

L	T	P
9	6	0

(15 Hrs.)

UNIT - IV

Bioinformatics Databases: Nucleic acid sequence Databases - GenBank, EMBL, DDBJ. Protein Sequence Databases - SwissProt, TrEMBL. Structure Databases - PDB, CATH, CSD. Literature Databases - PubMed, Scopus**.**

L	T	P
10	9	0

(19 Hrs.)

UNIT - V

Techniques in Bioinformatics: FASTA - BLAST - Types. Pairwise and Multiple Sequence Alignment methods and significance. - Molecular Visualization - JS Mol / RasMol. Prediction of Activity Spectra - PASS**.**

L	T	P
8	6	0

(14 Hrs.)

(Total: 75Hrs.)

Text Books :

1. Alexis Leon and Mathews Leon, *Computer Applications in Business*, Vijay Nicole Imprints, Chennai, 2013.
2. S. Ignacimuthu, *Basic Bioinformatics*, Narosa Publishing House. New Delhi-3, 2012.
3. P. Narayanan, *Bioinformatics - A Primer*, New Age International Publishers, New Delhi, 2005.
4. K. Teresa, Attwood and David J. Parry-Smith, *Introduction to Bioinformatics* Dorling Kindersley Pvt. Ltd. India, 2006.

Reference Books:

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

Practicals:

1. Working knowledge with computer in preparing word document, construction of line and bar graphs in Excel for the **Botanical sample data** provided.
2. E-mail creation.
3. Searching data bases prescribed in the syllabus.
4. Sequence alignment technique – FASTA and BLAST
5. Molecular Modeling

MSU / 2017-18 / PG – Colleges / M.Sc.(Botany) / Semester-III / Ppr.no.17 / Core-17

Research Methodology, Bioinstrumentation and Biological Techniques

L	T	P	C
3	2	0	4

Prerequisite:

Basic knowledge in biological and related informations to be useful for research and development during undergraduate programme

Objectives:

- To understand the basic aspects in research
- To learn mathematical and statistical technique for research
- To acquire basic knowledge about various instruments and techniques in biological research

Outcome:

- Training and participating in active research activities for their academic and professional levels
- Creation of novel ideas and simple techniques useful to the society (R/D)
- Acquire background knowledge in research publication and thesis writing

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- Reference Collections- Planning and preparation of thesis: thesis format. Journal format - Editing & Proof correction, Abstract and keywords. Full paper, Short Communication, Monographs, Review Articles. Citation index, Impact Factor. Methods of Oral and Poster presentation.
(**22Hrs.)**

L	T	P
12	10	0

(22 Hrs.)

UNIT- II

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

L	T	P
8	6	0

(14 Hrs.)

UNIT – III

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

Cytochemical and histochemical methods- Types of Microtomes: rotary, wood and cryo types. Microtome techniques: Fixation, dehydration, clearing, embedding, sectioning, staining, mounting. Cytochemistry and detection of nucleic acids, carbohydrates, proteins and lipids in plant cells / tissue**.**

L	T	P
10	4	0

(14 Hrs.)

UNIT - IV

Centrifugation: High speed, and Ultra centrifuges, **Spectroscopy:** Flame photometer;UV-Vis Spectrophotometer, AAS, **Chromatography:** TLC and GC**.**

L	T	P
6	5	0

(11 Hrs.)

UNIT -V

Electrophoresis: Basic principles, theory and applications of starch gel, agarose, native and denaturing PAGE. **Radio labelling techniques:** Handling of Radioisotopes in labs, Dosimetry, Ionization chamber, GM counter, Solid and liquid scintillation counters, Autoradiography. Radio Immuno Assay. Introduction to **Nanobiotechnology** methods in Nanodrugs delivery.

L	T	P
9	5	0

(14 Hrs.)

(Total: 75Hrs.)

Text Books:

1. N. Gurumani, Research Methodology for Biological Sciences, 2011
2. N. Gurumani An introduction to Biostatistics. MJP Publishers New Delhi, 2009.

Suggested References

1) W.W. Daniel, 1995.Biostastistics.7th edition, John Wiley and Sons, Newyork, USA.
2) C.I. Bliss, 1970. Statistics in Biology.Vol I and II, Mc Graw-Hill Inc.USA.
3) M. R. Green, and J. Sambrook, 2012. *Molecular Cloning: A Laboratory Manual*. 4th Edition, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.
4) I.A. Khan, and A. Khanum, 1994. *Biostatistics*. Vikas Publishing House Pvt. Ltd. New Delhi.
5) V.G. Panse, and P.V. Sukhatme, 1967. *Statistical Methods for Agricultural Workers*. ICAR, New Delhi.

6) D.T. Plummer, 1988. *An Introduction to Practical Biochemistry*. Tata McGraw Hill Publishing Company. New Delhi.

7) Raghuvanshi. 1995. *Practical Exercises in Cytology, Genetics, Plant Breeding and Bioststistics*. CBS Publishers & Distributors, New Delhi.

8) G.S. Sandhu, 1990. *Research Techniques in Biological Sciences.*1st Edition. Anmol Publications, New Delhi.

9) R.G.D. Steel, and J.H. Torrie, 1960. *Principles and Procedures of Statistics with special reference to Biological Sciences. McGraw-Hill.*

10) K. Wilson, and J. Walker, 2000. *Principles and Techniques of Practical Biochemistry*. Cambridge University Press, London.

11) E. Balagurusamy, 2009. Fundamentals of Computers. Tata McGraw-Hill Education Pvt. Ltd., New Delhi.

12) V. Rajaraman, Introduction to Information Technology. PHI. New Delhi.

Practicals

1. Demonstration of microscopes (Light and Dark field, phase-contrast, fluorescence, SEM, TEM).
2. Demonstration of centrifugation (Ultra, high speed).
3. Demonstration of TLC, UV-Vis Spectrophotometer, Flame photometer.
4. Separation of plant proteins using SDS-PAGE, and DNA by AGE.
5. Demonstration Microtomy: preparation of thin sections and permanent slides.
6. Histo-chemical localization of soluble components in plant cells- proteins, sugars, polysaccharides, lipids, nucleic acids, tannins, phenols, etc.
7. Study on Bioinstruments and Biological techniques
8. Problems from Biostatistics – SD & SE, T-test.

Taxonomy of Angiosperms and Economic Botany, Research Methodology, Bioinstrumentation and Biological Techniques (Total: 60 Hrs.)

Practicals

L	T	P	C
0	0	4	2

Taxonomy of Angiosperms and Economic Botany (30Hrs.)

1. Identification of plant species included in the syllabus.
2. Preparation of dichotomous key.
3. Identification of Binomial using flora (J.S. Gamble).
4. Dissection and technical description of plants from any locally available plants
5. A study tour of Taxonomic interest (any area) – Submission of an album with 10 photographs +10 herbarium plant specimens from the prescribed families and field note book.
6. Spotters for Economic Botany - to know the family, binomials of economically important plants, their parts and economic importance.

Research Methodology, Bioinstrumentation and Biological Techniques (30Hrs.)

1. Demonstration of microscopes (Light and Dark field, phase-contrast, fluorescence, SEM, TEM).
2. Demonstration of centrifugation (Ultra, high speed).
3. Demonstration of TLC, UV-Vis Spectrophotometer, Flame photometer.
4. Separation of plant proteins using SDS-PAGE, and DNA by AGE.
5. Demonstration Microtomy: preparation of thin sections and permanent slides.
6. Histochemical localisation of soluble components in plant cells- proteins, sugars, polysaccharides, lipids, nucleic acids, tannins, phenols, etc.
7. Study on Bioinstruments and Biological techniques.
8. Problems from Biostatics – SD & SE, T-test

Biochemistry and Biophysics, Computer applications and Bioinformatics (Total: 60Hrs.)

Biochemistry and Biophysics (30Hrs.)

L	T	P	C
0	0	4	2

Practicals

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

Computer applications and Bioinformatics (30Hrs.)

Practicals:

1. Working knowledge with computer in preparing word document, construction of line and bar graphs in Excel for the botanical sample data provided.
2. E-mail creation.
3. Searching data bases prescribed in the syllabus.
4. Sequence alignment technique – FASTA and BLAST
5. Molecular Modeling

Plant Physiology

L	T	P	C
4	0	0	4

Prerequisite: Basic knowledge gained in undergraduate programme

Objectives:

- To develop understanding in the mechanisms of functioning of plant cells.
- To acquire basic knowledge in physiological processes
- To acquire knowledge on impact of environmental factors on physiological process

Outcome:

- Gain knowledge in functioning of cells
- Gain knowledge in crossroads of cell metabolisms
- Acquire knowledge in stress factors and their role in physiological processes

Plant Physiology

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.

L	T	P
15	0	0

(15 Hrs.)

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. C_3, C_4 and CAM pathways. Photorespiration and its significance**.**

L	T	P
14	0	0

(14 Hrs.)

UNIT - III

Plant Respiration: Glycolysis, Citric acid cycle and Mitochondrial electron transport - Oxidative phosphorylation and terminal oxidation - Beta oxidation - Glyoxylate Cycle. Nitrogen metabolism - Biological nitrogen - Mechanisms of Nitrate uptake and reduction - ammonia assimilation.

L	T	P
10	0	0

(10 Hrs.)

UNIT - IV

Physiological role and mechanism of action of cytokinins, ethylene and abscissic acid. Growth retardants - Morphactins and Brassinosteroids. Photoperiodism and Vernalizations - flower induction and development. Phytochrome - structure, properties and physiological role.Senescence and Abscission - physiological and biochemical changes.

L	T	P
12	0	0

(12 Hrs.)

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. Heat shock proteins - Stress resistance mechanisms.

L	T	P
9	0	0

(9 Hrs.)

(Total: 60Hrs.)

Text Books.

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

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 C_3 and C_4 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

L	T	P	C
4	0	0	4

Prerequisite:

Basic knowledge in Environmental science gained from undergraduate programme

Objectives:

1) To gain advanced knowledge about plants and their environment
2) To acquire knowledge about environmental issues
3) To understand and implement effective measures in biodiversity conservation programmes

Outcome:

1) Acquisition of knowledge about environmental science
2) Acquisition knowledge about the role of man in protecting the environment
3) Acquisition knowledge about biodiversity conservation and participation in conservation activities.

Plant Ecology and Conservation Biology

UNIT- I Aim and scope of Ecology - Methods of studying plant community. Ecosystem: Types of ecosystem: Terrestrial - Cropland and Aquatic ecosystems - fresh water, marine, estuarine and mangroves with special reference to trophic structures.

L	T	P
12	0	0

(12 Hrs.)

UNIT – II. Succession - causes, patterns of succession - xeroseres and hydroseres. Energy resources: utilization - Renewable and Non-renewable energy resources. Environmental Laws and Education.

L	T	P
8	0	0

(8 Hrs.)

UNIT - III Environmental pollution - Causes, consequences and control of pollution on Global environment. Global Warming. Soil erosion, conservation and Disaster management - Floods, Earth quake, Cyclones, Tsunami and Landslides.

L	T	P
10	0	0

(10 Hrs.)

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. Endemism and Red Data Book. Phytogeography: Dispersal and migration barriers hypothesis, Continental drift hypothesis, Land - Bridges hypothesis, Age and Area hypothesis.

L	T	P
14	0	0

(14 Hrs.)

UNIT - V Conservation Biology: current practices in conservation - Ecosystem approaches - Species based approaches–Social approaches - Chipko Movement. *In situ* conservation (Protected area, Biosphere Reserves, National Parks, Sanctuaries) and *ex situ* conservation (Botanical Gardens, Cryopreservation, Gene Banks, Seed Banks, DNA Banks. Role of organizations in Biodiversity management – IUCN and BSI.

L	T	P
16	0	0

(16 Hrs.)

(Total: 60Hrs.)

Text Books

1. S. Ignacimuthu, Environmental studies. MJP Publishers, India. 2013.
2. K.C. Agrawal, Environmental Biology. Agro-botanical Publications, India, 1987.

References

3. R. S. Ambasht, A Textbook of Plant Ecology. 3rd ed. Students' Friends Co. Varanasi, India,1974.
4. W. B. Billings, Plants and the Ecosystem. Wardsworth Publishing Co. Inc., Belmont, 1965.
5. K. A. Kershaw, "Quantitative and Dynamic Plant Ecology", Edward Arnold Publishers Ltd., London, 1973.
6. E. J. Kormandy, Concepts of Ecology. 2nd ed. Prentice Hall of India Pvt. Ltd., New Delhi, 1978.
7. Krishnan Kannan, "Fundamentals of Environmental Pollution". S. Chand and Co. Ltd., New Delhi, 1997.
8. J. Levitt, Responses of Plants to Environmental Stresses. Acad. Press, New York. 1980.
9. E. P. Odum, Ecology. 2nd ed. Oxford & IBH Publications, New Delhi, 1975.
10. P. C. Vashista, A Textbook of Plant Ecology. Vishal Publications, Jullunder, 1974.
11. O. H.Frankel, Brown, A. H. D. and Burdon, J. J. The Conservation of Plant Diversity. Cambridge University Press, London, 1995.
12. V. H. Heywood, Global Biodiversity Assessment. UNEP, Cambridge University Press, London. 1995.

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 - salinity and Alkalinity - Carbonate and bicarbonate. 3. Chemical Oxygen Demand (COD) of given water samples.

4. Estimation of oxidized organic matter in the soil by Walkley- Black method.
5. Study of the following:
   I. Interpretations of the following:
      1. Ecosystem types.
      2. Different seric stages.
      3. Environmental pollution impact study.
      4. Endemism.
      5. Conservation of Biodiversity

Applied Biotechnology

L	T	P	C
4	0	0	4

Prerequisite:

Basic knowledge on biotechnology and its applications gained during undergraduate programme.

Objectives:

- To train the students in advanced level of biotechnological principles and techniques.
- To understand the process, development of tissue culture through micropropagation and impact of transgenic plants.
- To develop the skill in pollution abatement through Biofuel production

Outcome:

- Gain knowledge in tissue culture and micropropagation in crop improvement programme.
- Acquire knowledge in the transgenic molecular pharming.
- Acquire knowledge in bioremedial measures in pollution control and biofuel production.

Applied Biotechnology

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

L	T	P
14	0	0

(14 Hrs.)

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*.

L	T	P
14	0	0

(14 Hrs.)

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. Biodegradable plastics.

L	T	P
12	0	0

(12 Hrs.)

UNIT - IV

Biomining – Bioleaching, Biorecovery of metals. Biosensors - Bioremediation methods - *In situ* and *ex situ* bioremediation - Enzyme technology - large scale production of fungal enzymes -extraction and purification methods involved - application of fungal enzymes in different industries.

L	T	P
10	0	0

(10 Hrs.)

UNIT – V

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

L	T	P
10	0	0

(10 Hrs.)

(Total: 60Hrs.)

Text books:

1. R.C. Dubey, Text Book of Biotechnology. S. Chand and Company Ltd., 2006.
2. U.Satyanarayana, Biotechnology. Books and Allied (P) Ltd, Kolkata, 2008.

Reference Books

1. H.S. Chawla, Introduction to Biotechnology. Oxford and IBH Publishing Company Pvt. Ltd., New Delhi, 2002.
2. M.K. Razdan, An Introduction to Plant Tissue Culture. Oxford and IBH Publishing Company Pvt. Ltd., New Delhi, 2003.
3. H.K. Das, Text book of Biotechnology. Wiley Dream tech India Pvt. Ltd., Delhi, 2005.
4. A. Slater, N.W. Scott and M.R. Flower, Plant Biotechnology: The genetic manipulation of plants. Second edition, Oxford University Press, 2010.
5. V. Kumar "Biodiesel from Algae" LAP Lambert Academic Publishing, 2012
6. R. Henrikson, Algae Microfarms: for home, school, community and urban gardens, rooftop, mobile and vertical farms and living buildings, CreateSpace Independent Publishing Platform, ISBN-13: 978-1483968261, 2013.
7. B.D. Singh , A.K. Singh, "Marker Assisted Plant Breeding" , Springer; First edition, ISBN-13: 978-8132237259, 2015.
8. B.D.Singh, Biotechnology: Expanding Horizons, Kalyani publishers; 4th edition, ISBN-13: 978-93272229822014.
9. M. J. Korenberg, Microarray Data Analysis: Methods and Applications (Methods in Molecular Biology) Humana Press; ISBN-13: 978-1627039093, 2014

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

Plant Physiology and Applied Biotechnology (Total: 60Hrs.)

L	T	P
0	0	4

Plant Physiology Practicals: (30Hrs.)

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 C_3 and C_4 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 - Colorimeter/Spectrophotometer.

Applied Biotechnology Practicals: (30Hrs.)

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.
6. Study of steps of genetic engineering for production of Bt cotton, Golden rice
7. Production of biofuels from algae, Mass cultivation of algae, *Spirulina*- SCP production.
8. Compulsory visit to institution(s) related in the field of Biotechnology

Plant Ecology and Conservation Biology Practicals (Total: 60Hrs.)

L	T	P
0	0	4

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 - salinity and Alkalinity - Carbonate and bicarbonate.
3. Chemical Oxygen Demand (COD) of given water samples.
4. Estimation of oxidized organic matter in the soil by Walkley- Black method.
5. Study of the following:

   I. Interpretations of the following:

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   4. Endemism.
   5. Conservation of Biodiversity

Medicinal Botany and Dietetics

L	T	P	C
3	0	0	3

Prerequisite:

Basic knowledge on Medicinal plants and its applications gained during undergraduate course.

Objectives:

- To promote good health by teaching the students about diet and nutrition.
- To educate the science of nutrition in preventing development of disease.
- To educate on the nutritional standards and specifications for the healthy person and patient to ensure and prevent mortality due to malnourishment.

Outcome:

- Gain knowledge about nutritive diet for different age groups
- Acquire knowledge about healthy food for normal person and patient
- Acquire knowledge in dietetics to prevent mortality due to malnourishment.

Medicinal Botany and Dietetics

Medicinal Botany:-

Unit –I

Study of the following plants with reference to their Habitat, Habit, Systematic position, Morphology of their useful parts and uses of: *Tinospora cordifolia* (Root), *Acorus calamus* (Rhizome), *Tylophora asthmatica* (leaf), *Terminalia chebula* (fruit), *Plantago ovata* (seed) and *Holarrhena antidysenterica* (bark).

L	T	P
14	0	0

(14 Hrs.)

Unit - II

Source, properties and medicinal uses of some phyto oils resources -Olive oil, Castor oil, Neem oil, Mentha oil and Lavender oil.

L	T	P
7	0	0

(7 Hrs.)

Unit - III

Dietetics- Therapeutic value of Indian plant foods- a) rice b) wheat; c) green gram, black gram, soya bean d) lemon, banana, Guava, e) Ginger, Turmeric, Coriander, Garlic, Cumin and Clove.

L	T	P
6	0	0

(6 Hrs.)

Unit – IV

Plant nutraceuticals- definition and sources. Study of plant foods (food as medicine) in the treatment of some selected diseases – anorexia, arthritis, constipation, diarrhoea, diabetes, psoriasis, hypertension and memory loss.

L	T	P
10	0	0

(10 Hrs.)

Unit- V

Plant foods as Antioxidants - Definition - types, PUFA, Probiotics, Prebiotics, Dietary fibers, Omega-3 fatty acids. Cosmeceuticals – Definition, Retinoic acid.

L	T	P
8	0	0

(8 Hrs.)

(Total 45Hrs.)

Text books:

1. S.G. Joshi, "Medicinal plants", Oxford and IBH Company Private Ltd.,New Delhi, 2000.
2. J.L. Raymond,"Krause's Food, Nutrition and Diet therapy"Saunders publishers, 2003.

References

1. K. K. Purohit and Gokhale, "Pharmacognacy",Nirali Publications, 1999.
2. A.K. Srivatsava, "Medicinal plants", International Book Distributors, Dehradun,2006.
3. S.N. Yoganarashimman, "Medicinal Plants India", Vol.2 TamilNadu, Inderline Publishing Private Ltd., Bangalore,DehraDun and Michigan, 2000.
4. S.K. Bhattachariya, Handbook on medicinal plants, pointer publishers Jaipur, 2004.
5. A.Farooqi and B.S. Sreeramu, Cultivation of medicinal and aromatic Crops, Universities Press, 2001.
6. R. T.Lagua and V.S.Claudio, "Nutrition and diet therapy Reference dictionary"4th edition,Jones &Barlett Learning, 1995.
7. B.Thomas and J.Bishop, "Manual of Dietetic Practice"Edited by Jone Gandy, 4th edition, Wiley Blackwell Publishing,Oxford, UK, 2007.
8. B.Srilakshmi, "Dietetics", New Age International publishers, 2007.
9. D.A.Vattem and V. Maitin, "Functional foods, Nutraceuticals and Natural Products DEStech Publications, INC, 2016.
10. John Shi "Functional Food Ingredients and Nutraceuticals Processing Technology", CRC Taylor and Francis Publishers, 2006

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M.Sc. Botany Project (Contact Hours)

C.Hrs	C
7+	8

Prerequisite:

The students should be able to understand and interpret the literature in their areas of research.

Objectives:

- To provide training in scientific skills.
- To prepare students for professional training programmes or entry level jobs in any area of Botany

Outcome:

- At the end of the project, students should have increased:
  - their capacity to think critically;
  - their ability to design, analyse and execute an experiment;
  - their confidence and ability in communication skills (in writing and oral).
  - in acquiring the literature collection methods, and interpreting the data of their scientific experiments etc.