ST. XAVIER'S COLLEGE (AUTONOMOUS)
Palayamkottai - 627 002

(Recognized as "College with Potential for Excellence" by UGC)
(Re-accredited with "A^{++}" Grade with a CGPA of 3.66)

SYLLABUS
M.Sc. BOTANY

(w. e. f. 2021 - 22)

Program Specific Outcomes

The Master's Programme in Botany is specially designed to equip and mould students fit for the current educational scenario. The programme aims to encourage students to take responsibility for developing themselves throughout their studies at our institution. It encourages students to reflect on the broader purpose of their education. The students who are completing M. Sc. Programme in Botany will reflect the following graduate attributes.

1. Clear, comprehensive and advanced mastery in the field of Botany.
2. Understand the advanced areas of biological sciences with special reference to Botany and its applied branches.
3. Skill in practical work, experiments, use of biological tool and techniques
4. Expertise in statistical analyses of data for better interpretations and problem solving.
5. Confidence to apply the acquired knowledge in practical life so as to make our country self-reliant.
6. Ability to suggest innovative programs to care for nature and life for sustainable development.
7. Awareness to explore the intricacies of life forms at cellular, molecular and nano level.
8. Motivation and enthusiasm to appreciate the beauty of different life forms.
9. Inspiration to disseminate the concept of biodiversity conservation.
10. Problem solving skills in students to carry out innovative research projects thereby enkindling in them the spirit of knowledge creation.
11. Proficiency in the use of recent and advanced biological technologies
12. Ability to appreciate and practice ethical principles in research and studies in the field of biological science

M. Sc. COURSE PATTERN
(WITH EFFECT FROM JUNE 2021)

SEM	CORE/ ELECTIVE	SUB CODE	TITLE OF THE PAPER	HRS.	CREDIT
I	CORE1	21PBOTC11	Plant Diversity I	5	5
	CORE2	21PBOTC12	Cell Biology and Genetics	5	5
	CORE3	21PBOTC13	Anatomy embryology and Morphogenesis	5	5
	Elective1	21PBOTE14	Plant tissue culture / Biodiversity and Conservation	5	5
	Practical I	21PBOP15	Plant Diversity I	3	2
	Practical II	21PBOP16	Cell Biology and Genetics (2 Hrs), Anatomy Embryology & morphogenesis(3 Hrs)	5	2
			Lib/Sem.	2	
			Sub total	**30**	**24**
II	CORE4	21PBOTC21	Ecology and Phytogeography	5	5
	CORE5	21PBOTC22	Plant Diversity – II	5	5
	CORE6	21PBOTC23	Molecular Biology and Genetic Engineering	5	5
	Elective2	21PBOTE24	Research Techniques / Organic farming	5	5
	Practical III	21PBOP25	Ecology and Phytogeography	3	2
	Practical IV	21PBOP26	Plant Diversity II (3 Hrs) & Molecular Biology and Genetic Engineering (2 Hrs)	5	2
			Lib/ Sem	2	
			Sub total	**30**	**24**

III	CORE7	21PBOTC31	Plant Physiology and Biochemistry	5	5
	CORE8	21PBOTC32	Plant and Animal Biotechnology (Interdisciplinary)	5	5
	CORE9	21PBOTC33	Biostatistics and Bioinformatics	5	5
	Elective 3	21PBOTE34	Plant Breeding and Horticulture / Industrial Microbiology	5	5
	Practical V	21PBOP35	Plant Physiology and Biochemistry	3	2
	Practical VI	21PBOP36	Plant and Animal Bio-Technology (3 Hrs) & Biostatistics and Bioinformatics (2 Hrs)	5	2
			Lib./Sem	2	
			Sub total	**30**	**24**
IV	CORE10	21PBOTC41	Taxonomy ofAngiosperms	5	5
	CORE11	21PBOTC42	Microbiology and plant Pathology	5	5
	Elective4	21PBOTE43	Project	12	5
	Practical VII	21PBOP44	Taxonomy ofAngiosperms and Microbiology and plant Pathology	6	3
	Lib./Sem.			2	
	Sub Total			30	18
	Grand Total			**120**	**90**
	STAND				1
I	ECC1	21PBOECC1	Botany For Competitive Examinations	30	2
II	ECC2	21PBOECC2	Phytochemistry and Pharmacognosy	30	2
III	ECC3	21PBOECC3	Medicinal Plants of India	30	2
IV	ECC4	21PBOECC4	Nano-Biotechnology	30	2
IV	ECC5	21PBOECC5	Forestry	30	2

PLANT DIVERSITY- I
THALLOPHYTA AND BRYOPHYTA
(SUB. CODE: 21PBOTC11)

SEMESTER - I	CORE – 1	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Recall the diversity of lower group of plant kingdom. (K1)
- Understand the process of evolution of various classes of plants of our planet. (K2)
- Explain the morphological and anatomical characters of algae, fungi and bryophytes. (K3)
- Apply the knowledge to identify the different species of algae, fungi and bryophytes.(K4)
- Classify the economic importance of lower group of plants and compare the different varieties to useful in human being.(K5)
- Justify the lower group of plants to sustenance the human being day to day life. (K6)

UNIT: I Algae

Definition and concepts of plant diversity.Classification of algae by Fritsch (1945).Thallus organization in algae.Algal pigments and food reserves and their importance in classification.Methods of reproduction in algae. Life-cycle patterns in Algae.Ecology of fresh water and marine algae.Culture of microalgae and mariculture.Economic importance of Algae.

UNIT: II

General characteristics (morphology, anatomy, reproduction and life cycle pattern) in Cyanophyceae, Chlorophyceae, PhaeophyceaeandRhodophyceae.

UNIT: III Fungi

Classification of fungi by Alexopoulos and Mims (1979).Thallus variation in fungi.Reproduction and life-cycle patterns in fungi.Sexuality in fungi - Parasexuality and Heterokaryosis.Sex hormones in fungi. Spores and spore dispersal mechanisms in major groups of fungi. Economic importance of fungi.

UNIT: IV

Structure and reproduction in Phycomycetes, Basidiomycetes, Ascomycetes and Deuteromycetes.**Lichens -** Classification by Miller (1984)General account on structure and reproduction.Economic importance of lichens.

UNIT: V Bryophytes

Classification by Rothmaler.Structural variations in the gametophytes and sporophytes of Sphaerocarpales, Marchantiales,Jungermannianiales, Calobryales, Anthocerotales, Sphagnales, Polytrichalesand Bryales.

REFERENCES

Algae

1. **Chapman, V.J & Chapman, D. J.1960.** The Algae, ELBS & MacMillan, London,
2. **Fritsch, F. E. 1965** (Rep.). Structure and Reproduction of the Algae. Vol. I &II. Cambridge Univ. Press.
3. **Kumar, H. D. 1990.** Introductory Phycology. Affiliated East West Press, NewDelhi.
4. **Prescott, G. W. 1969.** The Algae: A review. Bishen Singh &Mahendra Pal Singh, Dehradun.
5. **Round, E. E. 1973.**The Biology of the Algae. Edward Arnold Publishers, London.
6. **Sharma, O. P.**1986.Textbook of Algae. Tata McGraw-Hill Publishing Co. New Delhi.

Fungi:

1. **Alexopoulos, C. J. & Mims, C. W.** 1952. Introductory Mycology, East Wiley Ltd. New Delhi.
2. **Bessy, E. A.** 1971. Morphology and taxonomy of fungi. Hafner Publication Company, NewYork.
3. **Bilgrami, K. S. &Verma, R. N.** 1978. Physiology of fungi. Vikas Publishing House, NewYork.
4. **Deacon, J. W.** 1984. Introduction to modern Mycology. Blackwell Science Publication. Oxford.
5. **Dubey, H. C.** 1983. Introduction to fungi. Vikas Publishing House, New Delhi.
6. **Smith, G. M.** 1966. Cryptogamic Botany. Vol I. Tata McGraw Hill, New Delhi.
7. **Srivastava, S.** 1999. Fungi. Pradeep Publications, Jalandhar.

Lichens:

1. **Hale, M. E. (Jr.).** 1983. The Biology of Lichens. Edward Arnold, Maryland.

Bryophytes:

1. **Cavers, E.** 1964 (Rep.1981). The interrelationships of the Bryophytes. Dawsons of Pal Mall, England.
2. **Chopra, R. N. & Kumar, P. K.** 1988.Biology of Bryophytes. Wiley Eastern Ltd. NewDelhi.
3. **Prem Puri.**1981. Bryophytes. Atma Ram & Sons, Delhi.
4. **Watson, E. V.**1964. The structure and life of Bryophytes. Hutchinson & Co. London.

CELL BIOLOGY AND GENETICS
(SUB. CODE: 21PBOTC12)

SEMESTER - I	CORE – 2	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Recite the importance of cells, organelles of the living world (K1)
- Understand the concepts of cell division and heredity (K2)
- Demonstrate the Mendelian principles (K3)
- Outline the fundamental concept oftransfer traits from one generation following generation (K4)
- Justify the concepts of evolution in the origin of life (K5)
- Support the cytogenetic concept with different living system (K6)

UNIT: I

Cell Theory, Cell Structure, Cell Organelles and their function: Ultrastructure and function of biological membranes with special emphasis on plasma membrane and tonoplast, chloroplast, mitochondria, nucleus, Ribosome, microbodies, dictyosomes, lysosomes and endoplasmic reticulum. Cell Cycle - Biochemical and genetic mechanism. Cell communication and Cell adhesion.Apoptosis - intrinsic and extrinsic pathway.

UNIT: II

Cell division - mitosis, meiosis - cytokinesis and cell plate formation, role of cyclins and cyclin dependent kinases, mechanism of programmed motor movements, regulation of cell cycle; Cell cycle significance.Structure and morphology of chromosomes.Biochemical composition and ultrastructure of chromosome and chromatin - heterochromatin and euchromatin. Banding; Karyotype analysis.

UNIT: III

Geneticmaterial DNA,RNA,experimentalevidencesGenomesof mitochondriaand chloroplasts, semi autonomy of the organelles. Endosymbiotic theory. Mendelian principles: Dominance, segregation, independent assortment. Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests. Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Pedigree analysis.

UNIT: IV

Gene mapping methods: Linkage maps, tetrad analysis- Ordered type (Neurospora) and unordered type (yeast), mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of

function, germinal verses somatic mutants, insertional mutagenesis. Structural and numerical alterations of chromosomes: Deletion,duplication, inversion, translocation, ploidy and their geneticimplications.

UNIT: V

Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping Recombination: Homologous and non-homologous recombination including transposition. Cytogenetics of Polyploidsand Aneuploids – Allopolyploidy and Autopolyploidy its phenotypic effects. Techniques involved in physical mapping of chromosomes *in situ* hybridization, Fluorescence *in situ*hybridization.

REFERENCES

1. **Alberts, Johanson, Lewis, Raff, Roberts and Walter. 2002.** The molecular Biology of the cell. 4th Edition, Garland Science Publishing.
2. **Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and Darnell, J.**
   2000. Molecular Cell Biology, W.H. Freeman and Co., New York, USA.
3. **Brachet and Mirsky (ed.):** The Cell, Academic Press, Vols. 16.
4. **DeRobertis, E. D. P. and De Robertis, E. M.**
   F.2001. Cell and Molecular Biology, Lippineott Williams & Wilkins, Bombay.
5. **Wolfe, S. L. 1993.** Molecular and Cellular Biology,Wordsworth Publ. Co., California, USA.
6. **Gupta, P. K. 2009.** Genetics, 4/e. Rastogi Publications, Meerut.
7. **Lewin, B. 2007.** Genes IX. Wiley Eastern Ltd., New Delhi.
8. 8. **Snustad, D. P., Simmons, N. J. and Jenkins, J. B. 2003.** Principles of Genetics. John Wiely& Sons, New York.
9. **Strickberger, N. W. 1985.** Genetics 3rd Ed. Macmillan Co. New York.
10. **Hartl, D. L. and Jones, E. W. 1997.** Genetics: Principles and Analysis 4th Ed. Jones & Bartlett Publishers, Inc.
11. 11. **Sharma, A.K. and Sharma, A. 1980.** Chromosome Techniques. Theory and Practice, Butterworth.
12. **Russel, P.J. 1998.** Genetics(5thed). The Benjamin Cummings Publishing Company Inc., USA.
13. **William S. Klug ,Michael R. Cummings, Charlotte A. Spencer and Michael A. Palladino.**Concepts of Genetics (10th Edition) 10th Edition. Pearson publication

ANATOMY, EMBRYOLOGY &MORPHOGENESIS
(SUB. CODE: 21PBOTC13)

SEMESTER I	CORE: 3	HOURS: 5	CREDITS: 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Illustrate and examine various kinds and organization of plant tissues (K1).
- Analyze the ontogeny of plant structures (K3).
- Experiment and examine the wood anatomy of some economically important plant species available in the locality.(K4)
- Examine and illustrate the role of sexuality in plants (K6).
- Assess the importance of embryology in other applied fields of biology (K5)
- Discuss the role of symmetry and polarity in the overall body organization of the organism (K2)

ANATOMY:

UNIT: I

Tissues: Meristematic and permanent tissue - simple and complex tissues. Root and shoot meristems - theories. Xylem and phloem – components.

UNIT: II

Differentiation in xylem – wood anatomy – Tyloses- Reaction wood, heart wood and sap wood, growth rings; ontogeny and differentiation in phloem - procambium and vascular cambium - structure and function – seasonal activity of the cambium- Factors influencing cambial activity - normal and anomalous secondary growth (Monocots and Dicots)

EMBRYOLOGY:

UNIT: III

Microsporogenesis, development of male gametophyte; megasporogenesis, developmental types of female gametophytes; pollen germination, pollen tube growth and pollen tube discharge, mechanism of nuclear fusion. Compatibility and incompatibility, self-incompatibility; mechanisms, multigenic system, advantages/biological significance and methods to overcome incompatibility.

UNIT: IV

Embryogenesis and seed formation; Polyembryony; Apomixis: causes, significance – diplospory – apospory; Parthenocarpy: genetical, natural and induced; Endosperm: triple fusion and endosperm formation – types of endosperm.

MORPHOGENESIS:

UNIT: V

Definition-terminologies used in developmental botany; Nuclear - cytoplasmic interactions; differentiation – de-differentiation and re-differentiation. Polarity- origin of cell heterogeneity in plants, expression of polarity in internal and external structure. Symmetry - radial, bilateral, dorsiventral and asymmetry.

REFERENCES

1. **Bhojwani, S. S. &Bhatnagar, S. P. 2000**. The Embryology of Angiosperms. McGraw Hill.
2. **Chandurkar, P, 1977.** Plant Anatomy. Pergamon Press
3. **Maheshwari, P. 1971.** An introduction to the Embryology of Angiosperms. Tata McGraw Hill Publishing Co New Delhi.
4. **Pandey, S. N. &Chadha, A.** Plant Anatomy and Embryology. Sangam Books Ltd.
5. **Katherine Esau.** ***1953. Plant Anatomy, Wiley & sons***
6. **Sinnot, EW. 1967.** Plant Morphogenesis. McGraw-Hill, New York.

PLANT TISSUE CULTURE
(SUB. CODE: 21 PBOTE14)

SEMESTER - I	ELECTIVE - 1	HOURS -5	CREDIT -5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Recall the techniques used with the biological organisms (K1)
- Understand the methods of biotechnology used for the welfare of human beings (K2)
- Apply the concepts of genetic engineering for human wellbeing (K3)
- Compare the advanced areas of various techniques of plant biotechnology (K4)
- Synthesize any new ideas or methods of plant biotechnology (K5)
- Evaluate the various methods of plant biotechnology (K6)

UNIT: I

Concepts of basic techniques in plant tissue culture. Cell, tissue and organ culture - Isolation of single cells, selection and types of cells, tissue explants and organs for culture - Paper, raft nurse technique, Plating method, Microchamber techniques, cell suspension cultures - batch, continuous, chemostat culture - Synchronization of suspension culture. Totipotency- Invitro vascular differentiation

UNIT: II

Somatic embryogenesis-Basic requirements, Practical applications of SE, Synthetic seed, Loss of morphogenetic potential in embryogenic culture. In-Vitro pollination and fertilization- methodology, factors affecting seed set after invitro pollination, application.

UNIT: III

Somoclonal and gametoclonal variant, factors influencing variants, Molecular basis of variation, Isolation of variants, application in plant breeding. Cryopreservation and gene bank - Modes of preservation, preparation of materials for deep freezing, cryopotectors, storage strategies, assessment of successful cryopreservation, application and limitations.

UNIT: IV

In vitro production of secondary metabolities - Classification of secondary metabolites, Techniques of cell lines for high yields of sec.compounds, mass cultivation of plant cells, Immobilised plant cell culture, Hairy root culture. Biotransformation using plant cell culture.

UNIT: V

Application of tissue culture in forestry, horticulture, agriculture and pharmaceutical industry. The genetic manipulation of plants for: herbicide resistance(glyphosate), reducing the effects of viral disease and improvement of seed storage protein quality.

REFERENCES

1. **Adrian Slater, Nigel W.Scott & Mark R.Fowler.** Oxford Univ.Press. Plant biotechnology- the genetic manipulation of plants. Oxford Univ.Press
2. **Bhojwani, S. S. and Razdan, M. K. 1983.** Plant Tissue Culture: Theory and Practice. Elsevier Science Publishers, Netherlands.
3. **Dodds, J. H. and Roberts, I. W. 1985.** Experiments in Plant Tissue Culture. Cambridge University Press, UK.
4. **Fowler, M. W. 1986.** Industrial Application of Plant Cell Culture. In: Yeoman, M. M. (ed.). Plant Cell Culture Technology. Blackwell, Oxford, London.
5. **Hammoond, J., McGarvey, P. and Yusibov, V. 2000.** Plant Biotechnology. Springer Verlag, New York.
6. **Johri, B. M. 1982.** Experimental Embryology of Vascular Plants. Narosha Publishing House, New Delhi.
7. **Kalyan Kumar, De. 1992.** An Introduction to Plant Tissue Culture. New Central Book Agency, Calcutta.
8. **Ramawat, K. G. 2000.** Plant Biotechnology. S. Chand & Co., New Delhi.
9. **Razdan, M. K. 2004.** Introduction to Plant Tissue Culture. 2nd ed. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
10. **Reinert, J. and Bajaj, Y. P. S. 1977.** Plant Cell Tissue and Organ Culture: A Laboratory Manual, Narosa Publishing House, New Delhi.
11. **Vasil, I. K. 1986.** Cell Culture and somatic Cell Genetics of Plants. 3 Volumes. Academic Press Inc.

BIODIVERSITY AND CONSERVATION
(SUB. CODE: 21PBOTE 14)

SEMESTER - I	ELECTIVE – 1	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Understand the importance of biodiversity of the biosphere (K1).
- Acquire the knowledge of conserving biodiversity (K2).
- Compare the types of biodiversity of the local habitat (K3)
- Analyze the reasons for the loss of biodiversity of the natural habitat (K4)
- Inculcate the methods of conserving the existing biodiversity (K5)
- Create awareness among the public to conserving the respective nitches (K6)

UNIT: I

Introduction – biodiversity, concept, definition, types of biodiversity. Biodiversity in biogeographical regions and marine biodiversity.Biodiversity in relation to area, latitude, altitude.Biodiversity indicators – keystone species, flagship species and surrogate species.Ethical and aesthetic values of biodiversity.

UNIT: II

Genetic diversity – origin of genetic diversity. Measurement of genetic diversity – determinants of genetic diversity – genetic diversity of the Western Ghats, Eastern Ghats and Himalayas – loss of genetic diversity; strategies for prevention of loss of genetic diversity – Gene banks

Species Diversity – Species inventory, prospects and problems – monitoring of species diversity – Diversity Indices: species richness, species abundance, taxic diversity. Agro biodiversity and cultivated taxa in India.

UNIT: III

Ecosystem diversity – ecosystem types, tropical moist forests (Sholas), Arid and semi-arid ecosystems, freshwater and marine ecosystem, agroecosystems – measuring ecosystem diversity.

UNIT: IV

Loss of biodiversity – causes and factors, Red data Book, Conservation and management of biodiversity – importance and methods of conservation – *in situ* and *ex situ*. Biodiversity management –organizations associated with biodiversity management – IUCN, BSI, MoEF –biopiracy.

UNIT: V

Biodiversity hotspots, role of sanctuaries, national parks, biosphere reserves, sacred groves, zoological parks and botanical gardens in conservation. Species recovery programmes and reintroduction of locally extinct species.

REFERENCES

1. **AnushaKaushik and C. P. Kaushik. 2004.** Perspective in Environmental studies. New Age International (P) Ltd., Publishers; New Delhi.
2. **Heywood, V. H. and Watson, R. T. 1995.** Global biodiversity assessment. Cambridge University Press.
3. **Krishnamurthy, K. V. 2003.** An Advanced Text Book on Biodiversity. Oxford and IBH Publication Co. Pvt. Ltd., New Delhi.
4. **Sinha, R. K. andDalbir Singh. 1997.** Global Biodiversity. INA Shree Publishers, Jaipur.
5. **Singh, M. P., Singh, B. S. and Soma Dey. 2002.** Plant Biodiversity and Taxonomy. Daya Publishing House, Delhi.

PRACTICAL - I
PLANT DIVERSITY- I
(THALLOPHYTA AND BRYOPHYTA)
(SUB. CODE: 21PBOP15)

SEMESTER - I	**HOURS -3**	**CREDITS – 2**

Morphological and anatomical studies on vegetative and reproductive organs of the following taxa.

Algae:
1. *Chaetomorpha,*
2. *Pithophora,*
3. *Coleochaete,*
4. *Ulva,*
5. *Codium,*
6. *Halimeda,*
7. *Ectocarpus,*
8. *Padina,*
9. *Amphiroa,*
10. *Champia,*
11. *Gracilaria,*
12. *Rivularia,*
13. *Anabaena*
14. *Scytonema.*

Fungi and Lichens:
1. *Saprolegnia*
2. *Phytophthora*
3. *Albugo*
4. *Penicillium*
5. *Aspergillus*
6. *Xylaria*
7. *Peziza*
8. *Agaricus*
9. *Usnea.*
10. *Ganoderma*

Bryophytes:
1. *Dumortiera*
2. *Riccia*
3. *Targionia*
4. *Polytrichum*

**Field Visit to three different sites –Submission of field report (10 marks)*

PLANT DIVERSITY- I
(ALGAE, FUNGI, LICHENS AND BRYOPHYTES)
(SUB. CODE: 21PBOP15)

I. M.SC., BOTANY **TIME: 3 HRS**
SEMESTER: I **MARKS: 50**

1. Make suitable micro preparations of A, B & C. Stain and mount in glycerin. Draw labeled sketches and identify giving reasons. Submit the slides for valuation 3×8=24
2. Identify any two microalgae from the given algal mixture (D & E) 2×3=06
3. Draw labeled sketches and write critical notes on F, G, H, I & J 5×4=20

PRACTICAL II
CELL BIOLOGY, GENETICS, ANATOMY, EMBRYOLOGY AND MORPHOGENESIS
(SUB. CODE: 21PBOP16)

SEMESTER - I	HOURS -5	CREDITS - 2

CELL BIOLOGY AND GENETICS

1. Isolation of chloroplasts
2. Study of cell types – Guard cells, heterocysts, Sclereids, Storage cells
3. Use of fluorescent dye to visualize cell components
4. Smear preparations – *Allium cepa/ Zea mays / Tradescantia*
5. Determination of mitotic index
6. Preparation of Feulgen stained chromosome in root tip cells
7. Effect of colchicine on chromosome movements during mitosis
8. Karyotype analysis in plant species
9. Genetic problems on interaction of genes
10. Genetic problems on sex-linked inheritance
11. Chromosome mapping based on threepoints cross
12. Population genetics – Hardy Weinberg Law

ANATOMY:

1. Calibration of microscope and micrometry
2. Preparation of hand sections, maceration and clearing techniques.
3. Temporary and permanent mounting of whole specimens and sections
4. Microtome sectioning techniques.
5. Examination different cell and tissue types.
6. Wood anatomy of some common Indian timbers such as *Mangifera indica, Tectona grandis, Azadirachta indica, Thespesia populnea* and *Pterocarpus* sp.
7. Anomalous secondary growth: Dicots – *Achyranthes, Boerhaavia, Mirabilis, Bougainvillaea*. Monocot - *Dracaena.*
8. Study of anatomical characters of taxonomic importance-epidermal characters-study of stomata and cell inclusions.

EMBRYOLOGY:

1. Organization anthers and pollens, pollen wall patterns, pollen germination and pollen tube growth.
2. Study on ovary, ovules and their modification.
3. Effect of sucrose and pH on pollen germination
4. Determination of Pollen viability.
5. Observation on developmental stages of dicot embryo (Tridax/ Cucumber / Mustard)

MORPHOGENESIS:

1. Disruption of vascular continuity and regeneration of vascular tissues
2. Effect sugars and IAA on vascular tissue regeneration.
3. Effect of IAA and sugar on the apical bud.

CELL BIOLOGY, GENETICS, ANATOMY, EMBYOLOGY AND MORPHOGENSIS

(SUB. CODE: **21PBOP16**)

I. M.SC., BOTANY **TIME: 3 HRS**

SEMESTER: I **MARKS: 50**

1. Make suitable squash preparation of the given material A. Show the Metaphase/Anaphase to the examiners. Determine the mitotic index (4)
2. Do the karyotype analysis of the given material B with critical comments (4)
3. Solve the given problems C, D, E (12)
4. Write critical notes on F & G (5)
5. Make suitable micropreparations of the given material H. Draw the diagram, describe the anatomy and infer. Submit the slides (T.L.S & R.L.S) for valuation. (10)
6. By taking a lot I do the experiment and show the results and infer (8)
7. Write critical notes on J & K (7)

ECOLOGY AND PHYTOGEOGRAPHY
(SUB. CODE: 21PBOTC21)

SEMESTER: II	CORE: 4	HOURS: 5	CREDITS: 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

Understand the importance of interaction of biotic and abiotic factors. (K1)

- Learn the importance of ecology and ecosystems for the existence of the biosphere. (K2)
- Apply the methods of pollution control and biodiversity conservation. (K3)
- Analyse the reasons for distribution of plants and continental drift.(K4)
- Measure the environmental pollution factors and apply the knowledge to control the pollution. (K5).
- Adopt the methods of *in- situ* and *ex -situ* conservation of the local environment.(K6)

UNIT: I

History of ecology and relationship of ecology with other disciplines. The physical environment: atmosphere-composition, importance and zones in the atmosphere. Hydrosphere: properties of lotic and lentic waters. Zones found in lakes, streams and oceans. Cryosphere and its importance. Lithosphere: zones and their importance.

UNIT: II

Ecosystem: structure and function - homeostasis - ecosystem energetics. Laws of thermodynamics.Generalized energy flow model in an ecosystem.Primary production (methods of measurement, global pattern, controlling factors). Energy dynamics (trophic organization, energy flow pathways, ecological efficiencies), litter fall and decomposition (mechanisms, substrate quality and climatic factors), global biogeochemical cycles of C, N_2, P and S.

UNIT: III

Population ecology: population attributes - density, natality, mortality, growth pattern and dispersal of populations - life tables and age structure - population regulation. Concept of carrying capacity.Metapopulation: concepts and dynamics. Community ecology-concept, ecological niche, ecotones and edge effects.

UNIT: IV

Environmental pollution: air, water, soil and radiation pollution - sources; quality parameters; effects on plant and ecosystems. Climate change: Greenhouse gases (CO_2, CH_4, N_2, O_3, CFCs; sources, trends and role); ozone layer and ozone hole; consequences of climate change (Global warming, sea level rise, UV radiation).

UNIT: V

Phytogeography: Principles of phytogeography, types of plant distribution-theories of plant distribution-continental drift, theory of land bridges. Endemism and age and area hypothesis. Polytopy and polyphylesis, Centre's of origin of crop plants and area hypothesis-Endemism- plant explorations, invasions and introductions, local plant diversity, and their socio-economic importance.

REFERENCES

1. **Alan Wellburn, 1988,** Air pollution and acid rain - the biological impact Longman Scientific and technical Singapore.
2. **Begon, M. J. L. Harper, C. R. Townsend,1990,** Ecology Blackwell Scientific Publications Oxford
3. **Chhatwal, G. R. 1998.**Text Book of Biotechnology, Anmol Pub.
4. **Cunningham, W. P. &Saigo, B. W.1999.** Environmental Science The McGraw Hill Company, New Delhi
5. **Harrison, R. Max. 1990.** Pollution causes effects and control, Royal society of Chemistry, Great Britain
6. **Heywood, V. H. and R. T. Watson. 1995.** Global biodiversity assessment, Cambridge University Press
7. **Khan, T. I. and Shishodia, Y. S. 1998.** Environment and metal pollution, ABD publishers Jaipur.
8. **Kumar, H. D. 1994.** General ecology, Vikas publishing, New Delhi
9. **Mason, C. F. 1981.** Biology of Freshwater, Longman, London
10. **Mishra, S. R. and D. N. Saxena. 1992.** Aquatic ecology, Efficient offset printers, New Delhi
11. **Odum, E. P. 1983.**Basic Ecology, CBS College Publishing.
12. **Odum, E. P. 1996.**Fundamentals of Ecology.Nataraj publishers, New Delhi.
13. **Sinha, R. K. andDalbir Singh. 1997.** Global Biodiversity, INA Shree Publishers Jaipur.
14. **Thomas, M. Smith and Robert Leo Smith. 2007.** Elements of Ecology, Pearson Education
15. **Trivedi, P. R., Sharma, P. L. and Sudarshan, K. N. 1994.** Natural environment and Constitution of India, Efficient offset printers, New Delhi.
16. **Varshney, C. K. 1989.**Water pollution and management, S. P. Printers, Noida.

PLANT DIVERSITY- II
PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY
(SUB. CODE: 21PBOTC22)

SEMESTER - II	CORE - 5	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

1. Understandthe diversity, life-cycle patterns of pteridophytes and gymnosperms (K1)
2. Acquire the knowledge and evolutionary trends of pteridophytes and gymnosperms (K2).
3. Compare the diversity of pteridophytes and gymnosperms of locally available species (K3).
4. Identify the rare and economically important species of pteridophytes and gymnosperms(K4).
5. Comprehend the process of fossilization of pteridophytes and gymnosperms (K5).
6. Realize the available species of pteridophytes and gymnosperms in the current status (K6).

(Developmental studies not necessary)

UNIT: I (PTERIDOPHYTES)

Classification of Lycophytes and Ferns (Schneider *et al.* 2016); General life-cycle pattern, Apogamy, apospory and types.Structural variation and evolutionary trends in leaves (Telome theory), stele, sori in Pteridophytes. Gametophytes: Spore germination types (Nayar and Kaur, 1971) and morphological types of adult prothalli.

UNIT: II

General characteristics of sporophytes (morphology, anatomy, sporangia, spores) and gametophytes of living pteridophytes in Lycopodiopsida and Polypodiopsida (Equisetales, Ophioglossales, Marattiales, Hymenophyllales, Salviniales, Cyatheales, Polypodiales); Distribution of pteridophytes in India with reference to endemics. Medicinal importance of pteridophytes.

UNIT: III (GYMNOSPERMS)

Classification of gymnosperms (K. R. Sporne, 1965, up to family level); origin of Gymnosperms, general characters (morphology, anatomy, reproduction) and life-cycle pattern; Polyembryony with special reference to coniferales; ecology and distribution of gymnosperms in India with reference to endemic species.

UNIT: IV

Distribution, morphology, anatomy, reproduction and interrelationships of Cycadales, Coniferales, Taxales, Ginkgoales and Gnetales. Economic importance of gymnosperms.Industrial uses of wood values.

UNIT: V (PALEOBOTANY)

Geological era and distribution of plants, distribution of Pteridophytes and Gymnosperms in geological time scale.Fossilization process.General characteristics of Sphenophyllales, Bennetitales, Pentoxylales and fossil conifers.Fossil pteridophytes and gymnosperms from India.Fossil types.

REFERENCES

PTERIDOPHYTES:

1. **Bower, F. O. 1963** (Rep.). The Ferns Vols. I, II & III. Today &Tomorrow's Printers & Publishers, New Delhi.
2. **Campbell, D. H. 1970.**The evolution of Land plants. Central Book Dept. Allahabad.
3. **Copeland, E. B. 1947(Rep.1989).** Genera Filicum, the genera of Ferns. Waltham Mass.
4. **Foster & Gifford, 1959.** Comparative morphology of vascular plants. COH Freeman &Co.
5. **Rashid, A. 1976.** An Introduction to Pteridophytes. Vikas Publishing House, New Delhi.
6. **Smith, G. M. 1955 (Rep.1989).** CryptogamicBotanyVol. II. Tata McGraw Hill, New Delhi.
7. **Sporne, K. R. 1985.** The morphology of Pteridophytes. Hutchinson& Co. London.
8. **Manickam, V. S. &Irudayaraj, V. 1992.**Pteridophyte Flora of the Western Ghats, South India. B I Publications, Pvt. Ltd. New Delhi.
9. **Manickam, V. S. &Irudayaraj, V. 2003.**Pteridophyte Flora of Nilgiris, south India. Bishen Singh &Mahendra Pal Singh. Dehradun, India.
10. **Nayar, B. K. &Kaur, S. 1971.** Gametophytes of homosporous ferns. The Bot. Rev. 37: 295-396.
11. **Pullaiah, T. 2003.** Pteridophytes in Andhra Pradesh India. Daya Publishing House, India.
12. **Smith *et al.*, 2006.** A classification of extant pteridophytes. *Taxon* 55(3): 705-731.
13. **Schneider *et al.*, 2016.** A community-derived classification for extant lycophytes and ferns. The Pteridophyte Phylogeny Group. *J. Syst. &Evol*. 54: 563-603.

GYMNOSPERMS:

1. **Arnold, C. R. 1947 (Rep. 1979).** An Introduction to Palaeobotany. McGraw Hill Publishing Co. Ltd.
2. **Chamberlain, C. J. 1986.**Gymnosperms: Structure and Evolution. CBS, Publishers & Distributors, Delhi.
3. **Eames, A. J. 1972.** Morphology of Vascular Plants: Lower Groups. Tata McGraw Hill, New Delhi.
4. **Sporne, K. R. 1967.** The Morphology of Gymnosperms. Hutchinson & Co. London.
5. **Sharma, O. P. 1999 (3rd Edition).** Gymnosperms. PragatiPrakashan, Meerut, India.
6. **Subash Chandra Datta, 1966.** An Introduction to Gymnosperms. Asia Publishing House, Bombay.

PALEOBOTANY:

1. **Andrews, H. N. 1961.** Studies in Paleobotany, Wiley, N.Y.
2. **Bower, F. O. 1935.** Primitive Plants. Macmillan.
3. **Surange, K. R. 1966.**Indial Fossil Pteridophytes. Botanical Monograph, No. 4, Council of Scientific & Industrial Research, New Delhi.
4. **Sewart, W. N. 1983**. Paleobotany and the Evolution of Plants. Cambridge Univ. Press.
5. **Walton, 1951.** An Introduction to the Study of Fossil plants.

MOLECULAR BIOLOGY AND GENETIC ENGINEERING
(SUB. CODE: 21PBOTC23)

SEMESTER - II	CORE – 6	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Acquire knowledge modern scientific breakthroughs that influence society and development of science in molecular level. (K1)
- Understand the importance of DNA and the cellular machinery in transmitting the genetic information (K2)
- Apply the knowledge how to identify the genetic information in gene level. (K3)
- Analyze the genetic abnormalities and predict the remedy for that problem.(K4)
- Analyze the regulation of gene expression in cellular level. (K5)
- Summarize the overall functions of gene in human body and their importance. (K6)

UNIT: I

DNA and RNA structure: Primary, Secondary and supercoiling of DNA. Types of DNA & RNA, difference between DNA & RNA. RNA interference - replication: prokaryotic and eukaryotic DNA replication, mechanisms of DNA replication, Organization and functions of chloroplast and mitochondrial DNA- Chromatin Dynamics - C-Value Paradox - Transposons - types - significances, organization and functions of mitochondrial DNA.

UNIT: II

Transcription: Prokaryotic transcription, eukaryotic transcription, general and specific transcription factors, regulatory elements and mechanisms of transcription regulation, transcriptional and post-transcriptional gene silencing. Translation: Prokaryotic and eukaryotic, the translation machinery, mechanisms of initiation, elongation and termination, regulation of translation, co- and post-translational modifications of proteins. Protein targeting. Signal transduction (receptors and components of signal transduction pathway and mechanism)

UNIT: III - DNA sequencing:

Principle, dideoxy chain termination, chemical methods, Pyro sequencing and NGS.Strategies for genome sequencing; automated sequencing.Polymerase chain reaction: Principle and procedure; types, applications of PCR in basic and applied research. Blotting techniques: Concept of nucleic acid hybridization; Southern, Northern and Western blotting.Molecular markers: Types and characteristic features, Isozymes, RFLP, RAPD, AFLP, ISSR, MAS, QTLs, SSR and SNP techniques. DNA barcoding.

UNIT: IV

Gene Cloning Vectors.Plasmids, bacteriophages, phagemids, cosmids. Artificial chromosomes.BAC, PAC,YAC. Construction of genomic libraries and cDNA

libraries.mRNA enrichment, reverse transcription. Library construction and screening.DNA primers, linkers, adaptors. Enzymes in genetic engineering

UNIT: V

Identification of target gene - Gene transfer methods - physical - chemical and biological. Selection of transformed organisms - Plant genetic engineering using *Ti* plasmid - GMO, GMC, Selection of Transformed Organisms - Gene therapy - Bioethics - IPR and its applications, Human Genome Project.

REFERENCES

1. **Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter. P. 2005.** Molecular biology of the cell, Macmillan Publishers Ltd. New York, USA.
2. **Benjamin Lewin. 2008.** Genes IX Jones and Bartlett Publishers
3. **Brown, T. A. 2001.** Genomes, J Wiley & Sons, USA
4. **Cooper, G. M. and Hausman, R. E. 2006.** The Cell - A Molecular Approach,ASM Press and Sinauer Associates.
5. **Dabre, P. D. 1998.** Introduction to practical molecular biology, John Wiley and Sons Ltd. New York.
6. **Gilmartin, P. M. and Bowler, C. 2002.** Plant Molecular Biology (Volume 1 & Volume 2), Oxford University Press, UK.
7. **Harvey F. Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher (W.H.Freeman). 2008.** Molecular cell Biology.
8. **Karp, G. 2002.** Cell and Molecular Biology, J Wiley & Sons, USA.
9. **Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P. Baltimore, D. and Darnell, J. 2005.** Molecular Cell biology, Jones and Bartlett Publ., USA.
10. **Primrose, S. B., Twyman, R. M., Old, R. W. 2001.** Principles of gene manipulation Blackwell Publ UK
11. **Sambrook, J., Fritish E. F. and Maniatis, T. 2000.** Molecular cloning A laboratory manual, Cold Spring Harbor Laboratory Press, New York.
12. **Tania, A., Baker James, D. Watson Stephen Bell. 2004.** Molecular biology of gene Pearson Education.
13. **Twyman, R. M. and Wisden, W. 2000.** Advanced Molecular Biology, Springer Verlag, Germany.

RESEARCH TECHNIQUES
(SUB. CODE: 21PBOTE 24)

SEMESTER - II	ELECTIVE	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Understand the methods and approaches to research.(K1)
- Apply the methodology of scientific writing in their projects.(K4)
- Analyze the importance of research for the development of science and the welfare of the human race.(K5)
- Understand the basic principle working mechanism and application of the various instruments used in the Laboratory (K2)
- Examine the techniques in preparing biological specimens for research (K6)
- Experiment the knowledge of instrumentation in research projects (K3)

UNIT: I

Research techniques: meaning and objectives, methods and approaches in research. Literature and collection. Internet – World Wide Web – search engines and browsing tools – e journals and e books – Manuscript processing – citation and proof reading – thesis and journal format, preparation of full paper, short notes, review, thesis writing – bibliography.

UNIT: II

Microscopy: components of microscope, Principles of microscopy – stereo, phase contrast and fluorescence, electron microscopy (TEM and SEM) principle, instrumentation and application. Microtechnique: fixatives, stains, dehydration and embedding – sectioning with rotary microtome and staining. Micrometry – principle and methods of measurement of plant cells. Photomicrography - principle and methods.

UNIT: III

Spectroscopy: visible and ultraviolet spectrophotometry; Atomic absorption spectrophotometer: principle, working and its applications. Centrifugation: Principles, types and applications. pHmetry: Principles, electrodes, measurement of pH, buffers and its uses.

UNIT: IV

Chromatography – general principles,types– adsorption and partition chromatography. Thin layer chromatography, HPTLC, Gas liquid chromatography – High performance liquid chromatography – principles and applications. Scintillation counter, GM Counter, Radioisotopes in biology, X-ray crystallography. NMR – principle, instrumentation, uses in plant biochemistry.

UNIT: V

Electrophoresis principles and apparatus – vertical, horizontal and 2D – supporting media – agarose and polyacrylamide gels – detection, recovery and estimation of electrophorogram. Gel documentation system.

Molecular techniques: Principle and applications of Polymerase Chain Reaction – components in a PCR reaction – Inverse PCR, Reverse transcriptase mediated PCR (RT – PCR). Blotting techniques: Southern, Northern and Western Blotting.

REFERENCES

1. **Bryan, C Williams and Keith Wilson. 1983.** A biologist's guide to practical techniques of practical biochemistry, Second edition. Edward Arnold Publications.
2. **Anbalagan, K.** – Electrophoresis.
3. **David Plummer, 1987.** An Introduction to Practical Biochemistry, Tata McGraw Hill.
4. **Ed Metcalfe**, Atomic Absorption and emission spectroscopy, John Wiley and Sons.
5. **Jayaram, J. 1988.** Laboratory manual in Biochemistry, Wiley Eastern Ltd.
6. **Johansen, M. 1940.** Plant Microtechnique, McGraw Hill
7. **Stock, R and Rice, C. B. F. 1980.** Chromatographic methods, Chapman and Hall.
8. **Keith Wilson and John Walker., 1997.** Practical biochemistry IV edition,Cambridge Universities Press.
9. **Sharma, Y. R**. - Organic Spectroscopy

ORGANIC FARMING
(SUB. CODE: 21PBOTE 24)

SEMESTER - II	ELECTIVE – 2	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Acquire the knowledge of organic farming and its importance (K1)
- Understand the different techniques needed to practice organic farming (K2)
- Apply the learnt techniques practically in local level (K3)
- Identify the nutrient deficiency symptoms and the remedy various crop plants (K4).
- Manage the soil fertility by adopting various methods (K5)
- Develop the necessary skills needed to market the organic produce (K6)

UNIT: I

Organic farming – introduction and history of organic farming – importance of organic farming.Organic farming and its relevance to Indian and global agriculture, future prospects. Land management – land use, minimum tillage, use of cover crops.

UNIT: II

Water management – water use efficiency, preventing runoff water.Organic soil and crop management – mineralization of organic matter.Farming systems, crop rotation, multiple and relay cropping systems.Intercropping in relation to maintenance of soil productivity.

UNIT: III

Soil fertility and plant nutrition. Nutritional requirement of plants – compost and cover crops for organic farming – preparation and use of farmyard manure, compost, green manures, vermicompost, Panjakavium, biofertilizers and other organic concentrates – composition, availability and crop responses; recycling of organic wastes and residue management.

UNIT: IV

Nutrient deficiency symptoms and their remedy, nutrient deficiency diseases in crop plants.Control of weeds, diseases and insect pest management using biological agents, pheromones.Biopesticides.

UNIT: V

Socio-economic impact of organic farming; marketing of organic crops, marketing and export potential.Sorting, grading, labeling, inspection, certification, accreditation procedures; organic farming and national economy.

REFERENCES

1. **Nicolas Lampkin. 2003. Organic** Farming.
2. **Karl Schwnke.** Successful small scale farming: An organic approach.
3. **Lokeretz, W. 2007.***Organic farming – an international history. CAB International.*
4. **Eric Lichtfouse. 2009.** Organic farming, pest control and remediation of soil pollutants. Springer.

PRACTICALS - III
ECOLOGY AND PHYTOGEOGRAPHY
(SUB. CODE: 21PBOP 25)

SEMESTER - II	**HOURS -3**	**CREDITS - 2**

VEGETATION STUDIES:

1. IVI using Quadrats
2. IVI using point frame
3. Stratification
4. Crown cover area
5. Similarity index of strands
6. Interspecies association and Chi-square test

WATER ANALYSIS:

1. Estimation of Productivity in *Hydrilla*plant
2. Estimation of H_2S
3. Estimation of Na, K and Ca using flame photometer
4. Estimation of PO4
5. Qualitative and quantitative analysis of pesticide residue using GC
6. Identification of pesticide residues in water
7. Measurement of noise using sound level meter
8. Analysis of heavy metals
9. Microbial analysis of polluted waters.
10. Heavy metal analysis using AAS.

SEMESTER PRACTICAL
ECOLOGY (Sub. Code: 18PBOP25)

I M.Sc SEMESTER: II TIME: 3 Hrs MAX. MARKS: 50

1. By taking a lot, study the vegetation and infer **(15 + 10)**
2. By taking a lot, write the procedures, do the experiments and show the results. Tabulate your observation and infer **(15 + 10)**

KEY

1. IVI - Quadrat method
   - CC - 10 marks
   - IVI - 15 marks
2. Stratification - 10 marks
3. CC - 10 marks
4. Interspecies Association 15 marks
   Chi square test 10 marks
5. Similarity index 15 marks

PRACTICALS - IV
PLANT DIVERSITY- II, MOLECULAR BIOLOGY AND GENETIC ENGINEERING
(SUB. CODE: 21PBOP 26)

SEMESTER - II	HOURS -5	CREDITS - 2

PTERIDOPHYTES

1. Morphological and anatomical (except the marked ones) description (based on herbarium/ living specimens) of the following Pteridophytes; preparation of identification key.
2. *Lycopodium, Isoetes, Selaginella, Equisetum, Ophioglossum, Angiopteris, Lygodium, Pteris, Adiantum, Pteridium, Trichomanes, Dicranopteris, Cyathea, Christella, Asplenium, Athyrium, Diplazium, Dryopteris, Blechnum, Lepisorus, Marsilea.*

GYMNOSPERMS

1. Morphological description of sporophyte and reproductive organs and wood anatomy of following**:***Pinus, Araucaria, Cupressus, Podocarpus, Gnetum.*
2. Identification of endemic Pteridophytes and Gymnosperms of India byHerbarium specimens or photographs:
3. *Huperzia hilliana, Selaginella tenera, Osmunda hugeliana, Lindsaea malabarica, Cyathea nilgirinsis, Dryopsis scabrosa, Polystichum manickamii, Bolbitissemi cordata, Elaphoglossum beddomei, E. nilgiricum, Cycas beddomei, Gnetum sp.*
4. Fossil slides of Pteridophytes and Gymnosperms
5. **Field Visit** to any hill station to study the diversity of Pteridophytes and gymnosperms (10 marks)

MOLECULAR BIOLOGY AND GENETIC ENGINEERING

1. Extraction and estimation of DNA from plant material
2. Analysis of DNA by gel electrophoresis
3. Protein isolation from plant samples
4. Protein separation by polyacrylamide gel electrophoresis
5. To prepare a restriction digest by using different restriction enzymes
6. DNA amplification
7. Phylogenetic analysis of DNA profiles using NTSYS
8. ELISA test online simulation and Interpretation of results
9. Vector screening

PLANT DIVERSITY II & MOLECULAR BIOLOGY AND GENETIC ENGINEERING

(Sub. Code: 21PBOP 26)

I M. Sc., SEMESTER: II HOURS: 3 Marks: 50

1. Draw the habit of the given specimen 'A', describe the macro morphology and identify the Genus using the given identification key **(10)**
2. Take T. S of specimen 'B', Draw the labeled diagram and identify the type of stele or Identify at least three soral types from the soral mixture **(6)**
3. Spot at sight C,D&E **(3×3=9)**
4. By taking a lot (AGE/ PAGE/ Restriction digestion/ PCR) write the procedure and do the experiment. Comment on the result (s) / anticipated result (s). Draw the attention of the examiners to the critical steps. (**20)**
5. Using the given S.I. table construct the cladogram (**5)**

PLANT PHYSIOLOGY AND BIOCHEMISTRY
(SUB. CODE: 21PBOTC31)

SEMESTER – III	CORE – 7	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Understand the various mechanisms by which plants regulate their metabolism (K1).
- Comprehend the importance of light and photosynthesis in the life of plants (K2).
- Realize the various biomolecules that make up the body of a living organism (K3)
- Identify the role of different biomolecules in plant and other living system (K4)
- Analyze the existing various biomolecules of plant system by simple methods (K5).
- Realize the role of enzymes in all biochemical reactions of living organism (K6)

UNIT: I

Water relation – importance of water in plant life.Absorption and translocation of water. Uptake and mobilization of mineral ions: Pathway and Mechanism. Photosynthesis – ultra structure of chloroplast – thylakoid organisation – Photosystem I and II.LH complexes electron transport components – photophosphorylation – Oxygen evolving complex – KOK Model.Carbon assimilation- C_3, C_4 and CAM pathways.CO_2 concentration mechanism.

UNIT: II

Respiration- plant mitochondrial ET and ATP synthesis, Glycolysis, fermentation. Pasteur effect, Kreb's cycle, phosphorylation through oxidation electron transport chain – Role of uncouplers and inhibitors, PPP. Cyanide resistant respiration, climatic rise. Nitrogen metabolism – sources of nitrogen of the plants - biological nitrogen fixation (symbiotic and non-symbiotic) – assimilation of nitrate and ammonia – GS-GOGAT pathway. Intermediary metabolism.

UNIT: III

Plant growth regulators – classification- role of plant growth regulators in growth and development of plants.Phytochromes – structure, function and its action. Signal transduction. Flower development and its regulation. Plants defence mechanism- Role of secondary metabolites. Physiology of senescence and aging, Programmed cell death. Biochemical and Molecular basis of dormancy and germination.Circadian rhythm.

UNIT: IV

Carbohydrates – simple and conjugated sugars, nomenclature; structure ; stereochemistry – fischer projection, Haworth perspective, boat and chair conformation; glycoside formation; derivative sugar; glycoprotein and proteoglycans.

Protein- Protein classification; Primary, Secondary, tertiary and quaternary structure, Motifs and domains. Amino acid- classification and structure (polar, non-polar, aromatic and aliphatic) Nucleic acid (DNA, RNA)- Non watson – crick pairing, sugar puckering and base stacking; torsion angle, supercoiling; denaturation kinetics of DNA, cot curve.

UNIT: V

Enzymes- general characteristics, types and mode of action.Enzymes kinetics.Derivation of MichaelisMenton plot and Lineweaver Burke plot; enzyme inhibition; Reversible.Irreversible with one example in each case.

Lipids – simple and conjugated lipids, different neutral and polar classes, nomenclature of different fatty acids, lipidomics concept. Lipid metabolism - biosynthesis and oxidation of fatty acid, regulation of FAS, Phopholipid synthesis and sterol synthesis, relative oxygen species – formation, role and scavenging.

REFERENCES

1. **Bidwell, R. S, 1982.** Plant Physiology, Macmillan Publishing Company, New York.
2. **Devlin, R. M. 1975**. Plant Physiology, Affiliated East West Press Pvt Ltd.
3. **Hess, D. 1981.** Plant Physiology, Narosa publishing House, New Delhi.
4. **Kramer, P. J. 1983.** Plant & Soil water relationships, Tata McGraw Hill Publishing Company Ltd.
5. **Lawlor, D. W. 2001.** Photosynthesis 3rd Ed Viva Books Pvt Ltd, Chennai.
6. **Salisbury, F.B., & Ross, S., 1986.** Plant Physiology, CBS Publishers & Distributors.
7. **Taiz, L. and Zeiger, E. 2006,** Plant Physiology, 4th Ed Sinauer Associates Inc Publishers, Massachusetts USA.
8. **Albert, L. Lehningher. 1975.** Biochemistry, Kalyani publishers, Ludhiana.
9. **David, L. Nelson and Michael, M. Cox. 2000.** Principles of biochemistry MacMillan publishers New York
10. **Eric, Conn and Paul Stumpf. 1987.** Outline of Biochemistry John Wiley & Sons Pvt Ltd Singapore
11. **LubertStryer. 1995.** Biochemistry WH Freeman and Company New York
12. **Philip, W. Kuchel& Gregory, B. Ralston. 1988.** Theory and problem of Biochemistry Schaum's outline series McGraw Hill book company New Delhi
13. **Robert, K. Murray *et al* 1998.** Harper's Biochemistry Prentice Hall International Inc Singapore

PLANT & ANIMAL BIOTECHNOLOGY (INTERDISCIPLINARY)
(SUB. CODE: 21PBOTC32)

SEMESTER - III	CORE – 8	HOURS -5	CREDITS – 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Acquire the knowledge of principles of biotechnology and genetic engineering (K1)
- Understand the methods of Biotechnology which help the entire humanity (K2)
- Compare the advantages and disadvantages of modern techniques (K3)
- Apply the concepts of genetic engineering for animal wellbeingespecially human (K4).
- Develop new techniques which can be influence the existing models (K5)
- Adopt any feasible ecofriendly methods for the betterment of human being (K6)

UNIT: I. PLANT BIOTECHNOLOGY

Introduction, History, scope and concepts of basic techniques in plant tissue culture.Laboratory requirements and organization. Sterilization and disinfection: physical and chemical. Media preparation: Inorganic nutrients, organic supplements, carbon source, gelling agents and growth regulators. Totipotency, differentiation,dedifferentiation and redifferentiation.Establishment of callus, dynamics of callus growth, organogenesis and embryogenesis.

UNIT: II. MICROPROPAGATION & HYBRIDIZATION IN PLANTS

Micropropagation: Stages of micropropagation, factors affecting shoot multiplication, application and limitations. Production of virus free plants (cryo, chemo and thermotherapies). somatic hybridization (Protoplast isolation and fusion techniques and mechanism), selection of somatic hybrids, uses of somatic hybrids and cybrids. Production of haploids (anther, pollen and ovule culture) and their uses. Agrobacterium mediated transgenic plant production.

UNIT: III rDNA TECHNOLOGY

Recombinant methods: construction of recombinant DNA, Introduction of recombinant DNA into host cells, Selection and multiplication of recombinant host cells, expression of cloned gene - bacterial, animal and plant vectors. Cloning vectors - plasmids - PBR322, *Ti* plasmids, cosmids, phagemids, lambda bacterium, phages - M13, transposons, restriction enzymes; Sanger method of DNA sequencing, cDNA library, BAC, YAC, MAC.

UNIT: IV ANIMAL CELL CULTURE

Characteristic features of animal cells in growth; Requirements - culture media, equipment; Isolation of animal tissue; Establishment of cell culture - primary, secondary cell culture and cell lines; Organ and embryo culture, IVF technology, transgenic animals

UNIT: V BIOTECHNOLOGICAL APPLICATIONS

Molecular farming in plants (immunotherapeutic drugs, edible vaccines, antibodies and interferons, agroinfiltration mediated expression, bio-safety issues in plant molecular farming. Insect and herbicide resistant transgenic plants; Monoclonal antibodies, DNA finger printing, interferons, Recombinant vaccines, insulin and somatotropin production, Applications of transgenic animals, Gene therapy and immunotoxins.

TEXT BOOKS

1. **Dubey, R. C. 2014.** Advanced Biotechnology, S.Chand& Company, New Delhi.
2. **Satyanarayana, U. 2008.** Biotechnology, Book and allied Ltd.
3. **Das, H. K. 2006.** Text book of Biotechnology

REFERENCES

1. 1. **Yadav Rajiv Tyagi, P. R. 2006.** Biotechnology and animal tissues. Discovery publishing house
2. **Singh, B. D. 2014.** Biotechnology expanding horizons, Kalyani publishers
3. **Prakash S. Lohar. 2012.** Text book of Biotechnology, MJP publishers.
4. **Sandy B. Primrose. 2006.** Principles of gene manipulation and genomics, Oxford
5. **Gupta, P. K. 2004.** Biotechnology and Genomics. Rastogi Publication Corporation, Meerut.
6. **BiswajitGhosh, 2005.** Plant tissue culture, Universities press.
7. **Gupta, P. K. 2000.** Elements of Biotechnology, Rastogi and Co.
8. **Chawla, H. S. 2004.** Introduction to plant Biotechnology, second edition oxford and IBH, New Delhi

BIOSTATISTICS AND BIOINFORMATICS
(SUB. CODE: 21PBOTC33)

SEMESTER - III	CORE - 9	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Recall the principles and concepts of biology, computer science and mathematics (K1)
- Describe the basic concepts of bioinformatics and its significance in biological data analysis (K2)
- Explain the basics of sequence alignment and analysis (K3)
- Demonstrate the technique in retrieval of data from biological databases (K3)
- Solve the problems associated with molecular modeling and phylogenetic analysis (K4)
- Outline the application of bioinformatics tools in biology (K5).
- Justify the necessities of bioinformatics in modern biological research (K6).

UNIT I

Biostatistics - uses and applications. Measures of central tendency and dispersion - arithmetic mean, median and mode; Quartile deviation, standard deviation and standard error (Raw, grouped - continuous and discontinuous data).Skewness and Kurtosis.

UNIT: II

Correlation - types - Karl Pearson's coefficient of correlation – Rankcorrelation - Regression. Testing of hypothesis: Basic concepts, simple and composite hypotheses, two types of errors, critical region, significance level, size and power of the test, p-value and its interpretation, Confidence interval - Test of significance ANOVA - one way and two way.Non parametric tests: Spearman's Rank Co-relation.

UNIT: III

Introduction to bioinformatics – Aim and scope and applications- Major areas of Bioinformatics- Genomics- Proteomics- databases in bioinformatics – types of databases – resources in NCBI, EMBL, DDBJ, PDB , PIR AND SWISSPROT – Specialized databases- Data retrieval methods.

UNIT: IV

Tools and softwares in bioinformatics - similarity search- BLAST- FASTA- sequence alignment tools- molecular visualization tools- Prediction tools- docking tools- Homology modelling – drug designing – DNA Microarray.

UNIT: V

Computational biology – Genetic algorithms – dynamic algorithm- Needleman-Wunsch. Algorithm – heuristic algorithm – Protein structure prediction methods. Global and local alignment.molecular phylogeny. Two sequence- Dynamic programming. Database similarity search- one sequence vs database.Word method- BLAST/FASTA.

REFERENCES

1. **Ghosh, Z. and Bibekanand, M. 2008.** Bioinformatics Principles and Applications Oxford University Press.
2. **Pevsner, J. 2009** Bioinformatics and Functional Genomics II Edition Wiley-Blackwell.
3. **Campbell, A. M. and Heyer, L. J. 2006.** Discovering Genomics Proteomics and Bioinformatics II Edition Benjamin Cummings.
4. **Gurumani, N. 2010.** An Introduction to Biostatistics, MJP Publishers India.

PLANT BREEDING AND HORTICULTURE
(SUB. CODE: 21PBOTE34)

SEMESTER - III	ELECTIVE – 3	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Understand the role of plant breeding in fulfilling the nutritional and material needs of the human population (K1).
- Summarize the various procedures and rules to be followed while breeding plants(K4).
- Examine the application of molecular biology in plant breeding (K6).
- Discuss Intellectual property rights and plant breeder's rights (K5).
- Describe the techniques of cultivation and propagation of pomology (K2).
- Compare and contrast the floricultural practices of locally cultivated flowers (K3).

UNIT: I

Plant breeding, Objectives, methods of crop improvement, simple and honored methods of selection, hybridization, methods of hybridization (pedigree and back cross) - Genetic basis of heterosis and production of hybrid seeds.Plant introduction and acclimatization - Mutation breeding - types and mode of mutagens, mutagen treatment and selection of mutants, introduction of mutation through tissue culture, significance of induced mutations in breeding - breeding for resistance to diseases and insect pests.

UNIT: II

Plant breeders' rights - methods of multiplication of seed, seed certification, labeling, legislation of intellectual property rights in relation to crop plants (both agricultural and horticultural plants). Molecular approaches to crop improvement - basic tenants of molecular biology, gene cloning, molecular markers, application of markers in breeding. Breeding of rice, cotton and sugarcane.

UNIT: III

Introduction - divisions of Horticulture - propagation of horticultural crops - seed propagation. Seed: storage - germination - characteristics of good seeds - pure seeds and seed treatment. Asexual propagation - advantages and disadvantages.Methods: cuttings, layering, grafting, and tissue culture.

UNIT: IV

Fruit culture: orchard cultivation - establishment of Orchard: location and site selection planning - layout - planting methods - clean culture, cover crops, intercrops. Cropping and fruit set - unfruitfulness - causes and prevention - harvest - marketing and storage of fruits.

Special techniques - ringing, notching, smudging, de-blossoming, thinning, trimming

and pruning. Vegetable culture: Growing of vegetables and greens. Kitchen garden: site, layout and choice of plants.

UNIT: V

Importance and principles of ornamental garden making: layout and components of ornamental gardening. Lawns, Topiary and Pergolas.Indoor gardening and care of indoor plants.Floriculture.Cultivation of commercial and cut-flowers (Rose and Jasmine, Gerbera, Gladiolus, Anthurium, Carnations).Plants and Intellectual Property Rights, CBD, TRIPS, WTO, GATT and their implications on horticulture trade.Patents, patenting process, role of patent office.

REFERENCES

1. **Edmund Senn- Andrew- Halfacre . 1977.** Tata McGraw -Hill, New Delhi
2. **Kumar, N. 1987.** Introduction to Horticulture, Rohini Agencies.
3. **ManibhusanRao, 1991.** Text book of Horticulture, Mac Millan India, New Delhi.
4. **Muthusamy, S. 1970.** A guide on Horticulture, ValanPathipagam.
5. **Chadha, K. L.** Hand book of Horticulture, ICAR, and New Delhi.
6. **Sheela.V. 2011.** Fundamentals of Horticulture.MJPPublications.Chennai.
7. 7. **Chahal G, S. and Gosal, S.S. 2002.** Principles and Procedures of plant breeding. Narosa publishing House, New Delhi.
8. **Shukla, R. and Chandel, S. 1996.**Cytogenetics, Evolution and Plant breeding. Chand.S co. Ltd. New Delhi.

INDUSTRIAL MICROBIOLOGY
(SUB. CODE: 21PBOTE34)

SEMESTER - III	ELECTIVE – 3	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Recalls the importance of microbes in the day today life of human beings (K1)
- Comprehend the application of microbiology on industrial scale for the welfare of mankind (K2)
- Compare the various microbial products available in the modern industrial world (K3)
- Develop a new methods and processes to make different microbial products (K4)
- Adopt an ecofriendly product and make awareness among the public to exploit (K5)
- Use their ability to apply the knowledge of Industrial Microbiology in day to day life (K6).

UNIT: I

General introduction, history and development of industrial microbiology, scope of industrial microbiology. Microorganisms in industry: Introduction to bioprocess technology - Isolation, preservation and improvement of industrially important organisms. Substrates for fermentation processes.Medium optimization.

UNIT: II

Bioreactor design: Laboratory, pilot and large scale reactors. Plug flow reactors, enzyme reactors. Sterilization of media and air. Scale up and Scale down. Mass transfer of oxygen: Agitation and aeration, Determination of KLa, factors affecting KLa, fluid rheology. Inoculum development, aseptic inoculation and sampling.

UNIT: III

Microbial production of Antibiotics: penicillin, streptomycin, Interferons, vaccines, hormones; Enzymes: proteases, amylases

UNIT: IV

Microbial production of Amino acids: Glutamic acid, Lysine; Organic acids: Citric acid, acetic acid; Industrial Alcohol, Beer and wine.
Vitamins: Vit B12, B2 - Ergot alkaloids

UNIT: V

Microbial Exopolysaccharides: Xanthan, Alginate - Microbial Flavours: Diacetyl, Methyl ketones, Terpenes, Vanillin - Fermented food and dairy products: Starter cultures, science and technology of bread, cheese and yogurt manufacture.

REFERENCES

1. **Patel, A. H. 1999.** Industrial Microbiology. Macmillan India Ltd., New Delhi.
2. **Pelczar, M. H. and Cahn, E. C. S. 1993.** Microbiology. Tata McGraw H illPublishing Co. Ltd., New Delhi.
3. **Schegal, H. E. 1986.** General Microbiology. Cambridge University Press, London
4. **Trevan, M. D. *et al.* 1987.** Biotechnology: The Biological Principles. Tat aMcGraw Hill Publishing Co. Ltd., New Delhi.

PRACTICALS - V
PLANT PHYSIOLOGY AND BIOCHEMISTRY
(SUB. CODE: 21PBOP35)

SEMESTER - III	HOURS -3	CREDITS – 2

1. Determination of Km value by NR activity
2. Assay of amylase
3. Assay of Lipase
4. Assay of Peroxidase
5. Calorimetric estimation of IAA
6. Isolation of chloroplast abd assay of Hill activity
7. Estimation of total phenolic contents from plant sources
8. Colorimetric estimation of amino acid
9. Colorimetric estimation of Protein
10. Colorimetric estimation of Proline.
11. Separation of Amino acid using HPTLC
12. Isolation of plumbagin/Tannin

PRACTICALS - VI
PLANT AND ANIMAL BIO-TECHNOLOGY &
BIOSTATISTICS AND BIOINFORMATICS
(SUB. CODE: 21PBOP36)

SEMESTER - III	HOURS -5	CREDITS – 2

BIOTECHNOLOGY

1. Preparation of plant tissue culture media and Sterilization
2. Seed Culture
3. Embryo culture
4. Spore Culture
5. Micropropagation
6. Callus induction
7. Organogenesis and Somatic embryogenesis
8. Cell line culture
9. Haploid production
10. Single cell isolation
11. Protoplast isolation
12. Synthetic seed production
13. Plasmid DNA isolation
14. Bacterial DNA isolation
15. Agrobacterium mediated gene transformation

Biostatistics and Bioinformatics

1. Collection of data– census method; population size– sampling methods– random sampling lottery method, table of random numbers
2. Arrangement and classification of the data –Five tally frequency tables for continuous and discontinuous data– Histograms
3. Presentation of the data– Bar diagrams, Graphs, Cartograms, Pictograms, Pie chart
4. Measures of central tendency—Mean, Median and Mode.
5. Problems—skewness, kurtosis, correlation, regression, rank correlation,
6. ANOVA (one way, two way)- solving statistical problems using software.
7. Browsing the internet using website address and using search engines
8. Searching the databases
9. Retrieving DNA and Protein sequences
10. Retrieving protein structure
11. BLAST
12. Sequence alignment – pair wise and multiple using CLUSTAL W – T.COFFEE-MAFFT-MULTALIGN, KALIGN
13. RASMOL
14. PASS-prediction of activity spectra of substance
15. Protein function analysis

16. Gene prediction
17. ORF finding
18. Vec screen
19. Swiss 2D page

Industrial visit to a reputed Tissue Culture Laboratory

TAXONOMY OF ANGIOSPERMS
(SUB. CODE: 21PBOTC41)

SEMESTER - IV	CORE – 6	HOURS -5	CREDITS - 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Recall the principles and nomenclature of taxonomy of flowering plants (K1).
- Comprehend the importance of various fields of botany help plant taxonomy (K2)
- Compare different systems of classification along with their merits and demerits (K3)
- Explain the unique floral and taxonomical characters of the various families (K4)
- Identify the family and species of locally available plants (K5)
- Realize the economic importance of various species plants available in and around (K6)

UNIT: I

Aims and scope of plant taxonomy - taxonomic hierarchy- Ranks in the hierarchical system. Nomenclature - Codes and articles, typification, author citation- effectiveand valid publication, principle of priority - limitations - *Nominaconservanda* (names of families,genera and species), *Nominarejicienda* (Conservation ofnames)Herbarium methodology - Types and functions of herbaria - Floras and monographs.

UNIT: II

Taxonomic tools, construction of keys and types of keys - taxonomic evidences: Morphology, Anatomy, Cytology, Embryology, Palynology andPhytochemistry (chemosystematics) - Molecular systematics.

UNIT: III

Systems of angiosperm classification: Linnaeus, Bentham and Hooker, Engler and Prantl's systems of classification - merits and demerits of these classifications - Current trends in biosystematics - Phenetics and Numerical taxonomy - Cladistics - APG.

UNIT: IV

Study of vegetative and floral characters of the following families: *Ranunculaceae, Capparaceae, Caryophyllaceae, Tiliaceae, Rhamnaceae,Sapindaceae, Myrtaceae, Aizoaceae, Combretaceae, Anacardiaceae.*

UNIT: V

Gentianaceae,Boraginaceae,Scrophulariaceae,Verbenaceae, Nyctaginaceae, Aristolochiaceae, Orchidaceae, Commelinaceae, Arecaceae, Cyperaceae.

REFERENCES

1. **Henry, A. N. and Chandra Bose. 1980.** An Introduction to Botanical Nomenclature, Today and Tomorrows Publishers, Delhi
2. **Heywood. V. H.** Plant Taxonomy, Edward Arnold Publishing Ltd, London
3. **Lawrence, G. H. M. 1967.** Taxonomy of vascular plants, Oxford and IBH Publishing Company , New Delhi.
4. **Naik, V. N. 1982.** The Classification of Flowering Plants, Vikas Publishing house, Pvt. Ltd. Ghaziabad,
5. **Samuel, B. Jones and Arlene, E. Luchsinger. 1987.** Plant Systematics, McGraw Hill Book Company, New Delhi
6. **Sharma, O. P. 1996.** Introduction to the principles of Plant Taxonomy, Oxford IBH Publishing Company Limited.
7. **Sivarajan, V. 1996.** Introduction to the Principles of Plant Taxonomy, Oxford and IBH Publishing Company Private Limited, New Delhi.

MICROBIOLOGY AND PLANT PATHOLOGY
(Sub. Code: 21PBOTC42)

SEMESTER: IV	CORE: 11	HOURS: 5	CREDITS: 5

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Recall the basic principles of microbiology (K1)
- Understand the biological structure of microbes (K2)
- Analyse the importance of microbes in our lives and the ecosystem (K3)
- Compare the various facets of the life of a microorganism (K4)
- Apply the importance of microbes in the life of human beings and plants species (K5)
- Identify the diseases caused by microbes on plant and apply the control measures(K6)

UNIT: I

General microbiology; scope, branches and history. Bacterial reproduction- Conjugation, plasmid based conjugation (structure of F factor, regulation, DNA mobilization and transfer), Hfr conjugation. Chromosome mobilization by non F plasmids. Transformation and transduction. Applications of generalized transduction. Metabolism-Photosynthetic microorganisms, pigments and CO_2 fixation pathways in microbes.

UNIT: II

Applied Microbiology: Methanogens and methylotophs a general account, mechanism of production of methane. Microbial production of food-Microbial single cell proteins from bacteria and fungi, nutritional value and safety. Mushroom technology-Introduction and scope. Structure and formation of basidiocarp in *Agaricus*.Cultivation of mushrooms.Mycorhizae-scope and general account- Ecto, Endo and Arbuscularmycorhizae, Isolation, cultivation and inoculation techniques.

UNIT: III

Immunology- General account of immune systems and immunology, innate and acquired immunity, antigen –antibody interactions (types, structure, requirements). Detection of antibody (immunoelectrophoresis, ELISA, RIA).Applications of immunology in plant systems.

UNIT: IV

Plant Pathology: Introduction - scope, significance and terminology of plant pathology.Diseases- concepts, components and causes.Classification of diseases. Pathogenesis - pathogens and their mode of dissemination, prepenetration, penetration and post penetration, entry through natural openings, wounds and intact plant surfaces, role of enzymes and toxins in disease development.

UNIT: V

Defense mechanisms in plants, morphological and structural defense mechanisms, defense structures, existing before infection, biochemical. defense mechanisms, pre-existing defense mechanisms. Phytoalexins, defense through induced synthesis of proteins and enzymes. Integrated disease and pest management (IDPM).

REFERENCES

1. **Alexander, N.** Glazer and Hiroshi Nikaido. Microbial biotechnology WH Freeman and company New York
2. **Duby, R. C. andMaheswari, D. K. 2000.** A Text book of Microbiology, S Chand & Co Ltd, Delhi.
3. **Larry McKane, JudyKanelII.Ed. 1996.** Microbiology - essentials and applications McGraw Hill Inc. Newyork.
4. **Michael, J. Pelczar, JR *et al.* 1998.** Microbiology, Tata McGraw Hill publishing company, New Delhi.
5. **Powar, C. B. and Daginawala. 2000,** General Microbiology, Vols I & II, Himalaya Publishing House.
6. **Prescott Harley and Klein V Ed 2003.** Microbiology, McGraw Hill, New York,
7. **Purohit, S. S. 2000.** Microbiology-Agro Botanica, New Delhi.
8. **Rangaswami, G. 1988.** Diseases of crop plants in India, Prentice Hall of India Pvt Ltd, Delhi
9. **Sharma, P. D. 2000.** Microbiology and Plant Pathology, Rastogi& Co., Meerut.
10. **Singh. R. S. 1988.** Introduction to principles of Plant pathology, Oxford IBH Publishing Company, New Delhi.
11. **Stanbury, P. F. and Whitaker, A. 1997.** Principles of fermentation technology, Pergamon press.

PROJECT
(Sub. Code: 21PBOTC42)

SEMESTER: IV	ELECTIVE - 4	HOURS: 12	CREDITS: 4

EXPECTED OUTCOME

- The student will learn to apply the various tools and techniques studied
- The student will learn to frame a simple scientific hypothesis and test the hypothesis
- The writing and communication skills of the student will be developed

PRACTICALS- VII
TAXONOMY OF ANGIOSPERMS, MICROBIOLOGY AND PLANT PATHOLOGY
(Sub. Code: 21PBOP44)

SEMESTER: IV	HOURS: 6	CREDITS: 3

TAXONOMY OF ANGIOSPERMS

1. Use of Flora for the identification of specimens belonging to the families given in the syllabus,
2. *Ranunculaceae, Capparaceae, Caryophyllaceae, Tiliaceae, Rhamnaceae, Sapindaceae, Myrtaceae, Aizoaceae, Combretaceae, Anacardiaceae, Gentianaceae, Boraginaceae, Scorphulariaceae, Verbenaceae, Nyctaginaceae, Aristolochiaceae, Orchidaceae, Commelinaceae, Arecaceae, Cyperaceae.*
3. Exercises on the important articles of the Code
4. Exercises in Dichotomous key making – any family
5. Technical description of plants – semi-permanent preparation of dissected floral parts
6. Field trip for three days and Submission of 15 herbaria of local weed flora
7. Submission of Digital Herbarium – 30 photos

MICROBIOLOGY and PLANT PATHOLOGY

1. Preparation of selective and nonselective media
2. Enumeration of microbes in air, soil and water.
3. Observation of motility of microbes
4. Staining methods- simple and differential
5. Test for coliforms
6. Spoilage of milk (methylene blue test)
7. Screening and identification of VAM
8. Isolation of pathogens from infected tissues
9. Study of Endophytes from plant tissues
10. Spore ontogeny
11. Plant Diseases- Etiology of Paddy blast, Cassava Mosaic Virus, Citrus canker, Tikka disease of groundnut, Bunchy Top of Banana.

TAXONOMY OF ANGIOSPERMS, MICROBIOLOGY AND PLANT PATHOLOGY

II M. Sc. Botany **SEM: IV** **Time: 3Hrs** **Marks: 50**

1. Describe the important vegetative and floral characters which are taxonomically significant to specimens A& B. Based on them, assign the specimens to their respective families. **(2×5=10)**
2. With the help of flora supplied, write down the binomial of C & D **(2×2=4)**
3. On the basis of vegetative and floral characters, prepare a bracketed/Indented key for the specimens E, F, G, H & I **(3)**
4. Work out the problems J & K as per ICN and explain **(2×4=8)**
5. Enumeration of microbial flora from soil/ cool drinks/ water/ milk by serial dilution and pour plate or streak plate method **12**
6. Microbial antibiosis/ Methylene Blue Reduction Test **6**
7. Etiology notes **7**

BOTANY FOR COMPETITIVE EXAMINATIONS
(SUB. CODE: 21PBOECC1)

ECC: 1	CREDITS: 2	Dr. T. Leon Stephan Raj

OUTCOME

- The student will be empowered to face the competitive examinations, NET and SET examinations
- The student will have the capacity to prepare multiple choice questions and other type of questions to prepare for various examinations

UNIT I: Plant Taxonomy and Biosystematics

Nomenclature, purpose, principles and systems of classification; Taxonomy of higher plants, floras, manuals, monographs, index, catalogues and dictionaries, herbaria; Concepts of biosystematics, evolution and differentiation of species; Biosystematic and taxonomic tools; Origin, evolution and biosystematics of selected crops (rice, wheat, rape seed & mustard, cotton).

Economically important plants

Origin, history, domestication, botany, genetic resource activities, cultivation, production and use of: Cereals: Wheat, rice, maize, sorghum, pearl millet and minor millets. Pulses: Pigeon pea, chickpea, black gram, green gram, cowpea, soyabean, pea, lentil, horsegram, lab-lab bean, ricebean, winged bean, French bean, lima bean, sword bean. Oilseeds: Groundnut, sesame, castor, rape seed, mustard, sunflower, safflower, niger, oil palm, coconut and linseed.

UNIT II: Economically important plants

Origin, distribution, cultivation, production and utilization of economic plants of following groups such as Fibres: cotton, silk cotton, jute, sunnhemp, agave, flax and mesta (kenoff); Sugars: sugarcane, sugarbeet, sugarpalm and sweet sorghum; Fodders and green manure crops: Plantation crops: coconut, cocoa, tea; root and tuber crops-: potato, sweet potato, tapioca, aroids etc.

Origin, distribution, classification, production and utilization of Fruits: mango, banana, citrus, guava, grapes and other indigenous fruits; apple, plum, pear, peach, cashewnut and walnut; Vegetables: tomato, brinjal, okra, cucumber, cole crops, gourds etc.;
Fumigatories and masticatories: tobacco, betelvine, areacanut; medicinal and aromatic plants: sarpagandha, belladonna, cinchona, nux-vomica, vinca, mentha and glycirrhiza, plantago etc.; Narcotics: cannabis, datura, gloriosa, pyrethrum and opium; Dye-, tannin-, gum- and resin-yielding plants; Plant of agro-forestory importance: multipurpose trees/shrubs, subabool, Acacia nilotica, poplar, sesbania, neem etc.; non-traditional economic plants: jojoba, guayule, jatropha, carcus etc.

UNIT III: Biodiversity and Plant Genetic Resources (PGR)

Biosphere and biodiversity; plant species richness and endemism; concept and importance of plant genetic resources and its increasing erosion; Centres of origin and

diversity of crop plants, domestication, evaluation, bioprospecting; National and International organizations associated with PGR; Convention on Biological Diversity (CBD), recent issues related to access and ownership of PGR, IPR,. PBRs, farmers rights, sui-generis system etc.

Germplasm Augmentation

History and importance of germplasm collection, ecogeographical distribution of diversity, logistics of exploration and collection, use of flora and herbaria, random and selective sampling, genepool sampling in self and cross pollinated species; Concept, importance and ecogeographical considerations of introduction and exchange of plant germplasm; prerequisites conventions and achievements of PGR exchange.

UNIT IV: Germplasm Conservation

Principles and methods of conservation, in situ and ex situ methods, on farm conservation; Gene banks: short-medium- and long-term conservation strategies; seed physiology and seed technology in conservation; seed storage behaviour (orthodox, recalcitrant), field genebanks, clonal respositories. Gene bank management, gene bank standard for various crops, ISTA, AOSA, IPGRI guidelines, documentation of information in gene bank.

Biotechnology in PGR

Plant conservation biotechnology, biotechnology in plant germplasm acquisition; plant tissue culture in disease elimination, in vitro conservation and exchange; cryopreservation, transgenics exchange and biosafety issues; biochemical and molecular approaches to assessing plant diversity.

UNIT V: Plant Quarantine

Principles, objectives and relevance of plant quarantine; Regulations and plant quarantine set up in India; economic significance of seed borne pests, pathogens and weeds; detection and post entry quarantine operations, salvaging of infested/infected germplasm, domestic quarantine.

Germplasm characterization, evaluation, maintenance and regeneration

Principles and strategies of PGR evaluation, approaches in germplasm characterization and diversity analysis, concept of core collection, descriptors and descriptor states for data scoring; maintenance of working and active collections of self-cross-pollinated and vegetatively propagated crops, perennials and wild relatives; principles and practices of regeneration in relation to mode of reproduction, concept of genetic integrity, genetic shift, genetic drift and optimum environment; post-harvest handling of germplasm; PGR data base management.

Eligiblity: Any PG Courses

Mode of Evaluation: Multiple choice Questions based on NET and SET question pattern

PHYTOCHEMISTRY AND PHARMACOGNOSY
(SUB. CODE: 21PBOECC2)

ECC: 1	CREDITS: 2	Dr. L. Joelri Michael Raj

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Recall the various phytochemicals present in plants and their use as medicine (K1)
- Understand the basic principles of chemical compounds which used as medicine (K2).
- Compare the various biomolecules and its chemical nature (K3)
- Identify the plants used as adulterants in various medicines(K4)
- Develop a skill for the basic bioprospecting of locally available plants (K5)
- Apply the cultivational practices of locally available important medicinal plants (K6)

UNIT: I

Phytochemisry– Definition and Scope.Classification of crude drugs -morphological, therapeutic, chemical and taxonomical.Collection and processing of crude drug.Pharmacognostical studies of a crude drug-anatomical, physicochemical, antimicrobial and chemical.

UNIT: II

Drugs of biological origin (plants, animals, marine and minerals) and their pharmacological activities.Hydrocarbons and derivatives.Carbohydrates-phenols and derivatives-volatile oils and resins-Saponins and steroids-alkaloids-glycosides.

UNIT: III

Principles related to the commercial production-quality and standardization of natural products-Production of crude drugs, Quality control and drug adulteration.

UNIT: IV

A brief account of the botanical name, family, useful parts, characteristics, chemical constituents and adulterants of the following plants, *Ephedra*, *Glycyrrhizaglabra, Asparagus, Cinnamomumzeylanicum, Cinchona officinalis, Digitalis purpurea, Cassia senna, Crocus sativus, Elettariacardamomum, Ferula asafetida.*

UNIT: V

Cultivation and utilization of following medicinal plants: *Aloe vera*, *Atropabellodona, Gloriosasuperba, Withaniasomnifera, Catharanthusroseus*and *Rauwolfiaserpentina.*Export and import of medicinal plants in India-Prospects and constraints.Pharmacoinformatics and drug research.

REFERENCES

1. **Evans, W.C**. 1997. Pharmacognosy Harcourt Brace & Company Asia Pvt. Ltd.
2. **Farooqi A.A. and Sreeramu B.S.** 2001 Cultivation of Medicinal and Aromatic Crops Universities press
3. **Kokate, C.K., A.R.Purohitand S.R. Gokhale.**1997 Pharmacognosy-NiraliPrakashan.
4. **Wallis, T.E.** 1985 Text book of Pharmacognosy - CSB publishers, New Delhi.

Eligibility: M.Sc. Botany

Mode of Assessment: CIA Test.

MEDICINAL PLANTS OF INDIA
(SUB. CODE: 21PBOECC3)

ECC: 3	CREDITS: 2	Dr. G. Sahaya Anthony Xavier

COURSE OUTCOMES

By the end of the course the students will be able to:

- Know the medicinal wealth of our nation
- Know the importance of cultivation of medicinal plants
- Learn various tools and techniques needed for cultivation and marketing of medicinal plants

UNIT: I

Important medicinal and aromatic plants of India; Problems of overexploitation and deforestation; Rare and endangered species of medicinal and aromatic plants; Policies for their conservation, regeneration and sustainable use. Fundamentals of cultivation: medicinal plant cultivation in India, Agro climatic zones of India.

UNIT: II

Soil: components, types, physical and chemical properties, fertility and productivity. Cultivation of medicinal plants: season and time, selection and preparation of land for cultivation, tillage (different types), planting density, planting patterns; Methods of propagation: sexual and asexual (vegetative, budding, grafting, layering)

UNIT: III

General management: Irrigation: requirement, methods and time, irrigation efficiency, drainage; Mineral nutrition of plants: organic manures and fertilizers, mode and time of fertilizer application, fertilizer dosage calculation; Growth regulators; Weeds: methods of weed control

UNIT: IV

Diseases: cause of plant diseases (brief account of fungi, bacteria and viruses), Plant disease management: principles and control measures such as physical, cultural, biological and chemical methods; Pests: different types and important groups of insects and pests, their mode of attack and control measures (physical, mechanical, chemical, biological and cultural); Integrated disease and pest management

UNIT: V - Harvesting and Marketing

Harvesting: Methods of Harvesting of medicinal plants, Pre and post harvest treatments; Yield analysis; Cost-benefit analysis; authentic suppliers of seeds and planting materials. Marketing: Marketing of medicinal plants, Preparation of different types of products from medicinal plants.

REFERENCES

1. **Ambasta, S.P. (ed) 1988.**The useful plants of India. CSIR, New Delhi
2. **Bhattacharjee, S. K. 2004.** Handbook of Medicinal Plants (4th ed.). Pointer Publishers, Jaipur
3. **CSIR. 1971.** The Wealth of India. Vol. A-Z. Council for Industrial and Scientific Research, New Delhi
4. **Farooqui, A. A., Khan, M. M. and Sreeramu, B. S. 1997.**Cultivation of Medicinal and Aromatic Crops in India.NayaPrakash, Kolkatta
5. **KameswaraRao, C.2000.**Database of medicinal plants. KSCST, Bangalore
6. **Honda, S. S. and Kaul, M. K. 1996.**Cultivation and Utilization of Medicinal Plants. RRL, Jammu.

Eligibility: Any PG Science courses
Mode of Assessment: CIA Test.

NANOBIOTECHNOLOGY
(SUB. CODE: 21PBOECC4)

ECC: 4	CREDITS: 2	Dr. J. John Peter Paul

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Know about the importance of nanobiochemicals.
- Get the knowledge of ecofriendly nanoparticles
- Learn the uses of nanobiotechnology for the production of different materials

UNIT: I

Nanobiotechnology-introduction-definition- crystal-structure-two dimensional-three dimensional-planes in the crystals-reciprocal lattice-bonding in crystal-covalent-ionic-metallic-mixed-secondary.

UNIT: II

Synthesis of nanomaterials-physical-high energy ball milling-melt mixing-laser pyrolysis-chemical-colloidal route-microemulsion-biological-microorganism-plant extracts-proteins-template like DNA

UNIT: III

Green synthesis of nanoparticles-silver-gold-copper-zinc-titanium oxide-iron oxide-cadmium acetate.

UNIT: IV

Characterization of nanomaterials-colour change-UV-Visible spectroscopic-FT-IR-XRD-EDAX-SEM-TEM-AFM.

UNIT: V

Applications of nanomaterials-biotechnology and medical field-bactericidal-drug delivery system-plant tissue culture-agriculture.

REFERENCES

1. **Chattopadhyay, K.K. 2009.** Introduction to Nanoscience and Nanotechnology. Prentice Hall, India, Learning PVT. LTD.
2. **Shah, M.A and Tokeer Ahmad. 2010.** Principles of Nanoscience and Nanotechnology. Narosa publishing House.

Total: 30hr
Eligibility: M.Sc., Botany students
Mode of Assessment: Internal evaluation only (Assignment/Seminar/Written Test)

FORESTRY

(SUB. CODE: 21PBOECC5)

ECC: 5	CREDITS: 2	Dr. N. Maria Francis Jeffrey Bose

COURSE OUTCOMES (CO)

By the end of the course the students will be able to:

- Understand the principle of forestry and the forest wealth of India (K1)
- Realize the various methods of silvicultural practices (K2)
- Apply different methods of silvicultural practices in the local forest (K3)
- Compare the various forest products based on their economic importance (K4)
- Develop an adaptable forest management to maximize its return while conserving (K5)
- Become a lover of forest and conserve the locally available forest and their products (K6)

UNIT: I

General Silvicultural Principles: Ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests; methods of propagation, grafting techniques; site factors; nursery and planting techniques, nursery beds, poly-bags and maintenance, water budgeting, grading and hardening of seedlings; special approaches; establishment and tending.

UNIT: II

Silvicultural Practices - Clear felling, uniform shelter wood selection, coppice and conversion systems, Management of silviculture systems of temperate, subtropical, humid tropical, dry tropical and coastal tropical forests with special reference to plantation silviculture, choice of species, establishment and management of standards, enrichment methods, technical constraints, intensive mechanized methods, aerial seeding, thinning.

UNIT: III

Agroforestry – Scope and necessity; role in the life of people and domestic animals and in integrated land use, planning especially related to (i) soil and water conservation; (ii) water recharge; (iii) nutrient availability to crops; (iv) nature and eco-system preservation including ecological balances through pest-predator relationships and (v) Providing opportunities for enhancing biodiversity, medicinal and other flora and fauna. Agroforestry systems under different agroecological zones; selection of species and role of multipurpose trees and NTFPs, techniques, food, fodder and fuel security.

UNIT: IV

Forest Resources and Utilization: Environmentally sound forest harvesting practices; logging and extraction techniques and principles, transportation systems, storage and sale; Non-Timber Forest Products (NTFPs) - definition and scope; gums, resins,

oleoresins, fibres, oil seeds nuts, rubber, canes, bamboos, medicinal plants, charcoal, lac and shellac, katha and Bidi leaves, collection; processing and disposal.

UNIT: V

Forest economics: Fundamental principles, cost-benefit analyses;estimation of demand and supply; analysis of trends in the national and international market and changes in production and consumption patterns; assessment and projection of market structures; role of private sector and co-operatives; role of corporate financing. Socio-economic analysis of forest productivity and attitudes; valuation of forest goods.

REFERENCES

1. **Frederick S. Backer, 1950**. Principles of silviculture.McGraw Hill Book Co. NY,
2. **Donald Bruce and Grancis X. Schumacher.1950.** Forest menturation, McGraw Hill Book Co. NY,
3. **Neilsen L.B. Nielsen. DC and Balslev. 1989.** Tropical forests, Ed. Holm –Academic press, London,
4. **Chowdhuri.**Indian woods – six volumes, Ed. Pub. Forest research institute, Dehra Dun
5. **Manikandan, K. &Prabhu, S. 2010.**Indian Forestry.Jain Brothers, New Delhi.

Eligibility: M.Sc., Botany
Mode of Assessment: CIA Test.

St. Xavier's College (Autonomous), Palayamkottai
Department of Botany
Title of the Paper
CIA- CORE/ELECTIVE PAPERS

Class: I/II M Sc Semester – I-IV
Time: 2.00 Hrs Marks: 70
Part - A. Answer all the questions (1×8 = 8)

1. a. b. c. d.
2. a. b. c. d.
3. a. b. c. d.
4. a. b. c. d.
5. a. b. c. d.
6. a. b. c. d.
7. a. b. c. d.
8. a. b. c. d.

Part – B Answer all the following: (4 × 8 = 32)

9. a) (or)
   b)
10. a) (or)
    b)
11. a) (or)
    b)
12. a) (or)
    b)

Part- C Answer any TWO of the following (2 × 15 = 30)

13.
14.
15.