Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

(Autonomous)

Course Structure for M. Sc. I Sem II (Botany)

WEF: 2022-23 to 2024-25

Semester	Paper Code	Title of Paper	No. of Credits
I	PSBT111	Plant Systematics I	4
	PSBT112	Cell Biology	4
	PSBT113	Genetics and plant Breeding	4
	PSBT114	Advanced Botanical techniques	4
	PSBT115	Practical's based on PSBT111 and PSBT112	4
	PSBT116	Practical's based on PSBT113 and PSBT114	4
	HR1	Human Rights – I	4
	CYS1	Introduction to Cyber Security – I	4
II	**PSBT 211**	**Plant Systematics II**	**4**
	PSBT 212	**Plant Physiology and Biochemistry**	**4**
	PSBT 213	**Molecular biology and genetic engineering**	**4**
	PSBT 214	**Plant ecology and biodiversity**	**4**
	PSBT 215	**Practical's based on PSBT 211 and PSBT 212**	**4**
	PSBT 216	**Practical's based on PSBT 213 and PSBT 214**	**4**
	HR	**Human Rights – II**	**4**
	CYS	**Introduction to Cyber Security – II**	**4**

M.Sc. Botany

Program Outcomes (Pos) for M. Sc. Program

PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the discipline that forms a part of a postgraduate programme. Execute strong theoretical and practical understanding generated from the specific programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skill of critical thinking and understand scientific texts and place scientific statements and themes in contexts and also evaluate them in terms of generic conventions. Identify the problem by observing the situation closely, take actions and apply lateral thinking and analytical skills to design the solutions.
PO3	**Social competence:** Exhibit thoughts and ideas effectively in writing and orally; communicate with others using appropriate media, build effective interactive and presenting skills to meet global competencies. Elicit views of others, present complex information in a clear and concise way and help reach conclusions in group settings.
PO4	**Research-related skills and Scientific temper :** Infer scientific literature, build a sense of enquiry and able to formulate, test, analyse, interpret and establish hypothesis and research questions; and to identify and consult relevant sources to find answers. Plan and write a research paper/project while emphasizing on academics and research ethics, scientific conduct and creating awareness about intellectual property rights and issues of plagiarism.
PO5	**Trans-disciplinary knowledge:** Create new conceptual, theoretical and methodological understanding that integrates and transcends beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** Perform independently and also collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Class : M. Sc. I (Semester- II) Paper Code : PSBT 211

Paper : I Title of Paper : Plant Systematics – II

Credit : 4 No. of lectures : 60

A) Learning Objectives:

1. Create awareness and need of conservation of Cryptogamic diversity.
2. To give idea of economic importance of cryptogams.

B) Learning Outcome:

By the end of course students will be able to

CO1. Get knowledge about cryptogams to conserve Cryptogamic diversity.
CO2. Classify the cryptogams up to species level.
CO3. Get aware about the importance of Cryptogams.
CO4. Get knowledge about life history of algae, fungi bryophytes.
CO5. Explain the role of Algae, Fungi and Bryophytes in human welfare.
CO6. Aware about plant conservation in society.
CO7. Analyze industrial applications of algae.

Credit – 1. (15 Lectures)

Pteridophytes – Distinguishing characters, origin of Pteridophytes – Algal origin, Bryophyte origin; Apospory, Apogamy, Parthenogenesis, Telome Theory and Stelar Evolution **(6L)**

Classification of Pteridophytes as per Sporne System (1975), Indian Pteridology, Heterospory and seed habit and Economic importance of Pteridophytes **(4L)**

Fossil Pteridophytes - Psilopsida : *Rhynia*, Lycopsida : *Lepidodendron Lepidophyllum, Stigmaria* and *Lepidostrobus*, Sphenopsida : *Calamites* and *Annularia* **(5L)**

Credit - 2 (15 Lectures)

Psilopsida: Distribution, distinguishing characters, morphology and anatomy of sporophyte and gametophyte of *Psilotum* (**1L)**

Lycopsida : Distribution, distinguishing characters, affinities, morphology and anatomy of sporophyte and gametophyte of Lycopodiales, Selaginellales, Isoetales and their life cycle pattern **(4L)**

Sphenopsida : Distribution, distinguishing characters, morphology and anatomy of sporophyte and gametophyte, Life cycle pattern of Equisetales **(2L)**

Pteropsida / Filicophyta : Distribution, distinguishing characters, morphology and

anatomy of sporophyte and gametophyte of order Ophioglossales (1L), Marattiales (2L), Osmundales (1L), Filicales (2L) Marsileales (2L) **(8L)**

Credit - 3 (15 Lectures)

Gymnosperm : Distinguishing characters, distribution, affinities of gymnosperms with pteridophytes and angiosperms and economic importance of gymnosperms. **(4L)**

Classification of gymnosperm as per Sahni (1920), Chamberlain (1934), Sporne (1965) **(3L)**

Pteridospermales w.r.t general characters- *Lyngiopteris*, *Neuropteris*, *Glossopteris* and *Caytonia.* **(4L)**

Cycadeoidales- General characters, structure of *Cycadeoidea* (1L)

Pentoxylales- General characters, *Pentoxylon*, structure of secondary wood, male and female strobili, and contribution of Birbal Sahni **(2L)**

Cordaitales – General characters, structure of *Cordaites*. **(1L)**

Credit - 4 (15 Lectures)

General characters, affinities, morphology of sporophytes and gametophytes of living gymnosperm orders :

Cycadales **(3L)**

Ginkgoales **(2L)**

Coniferales **(5L)**

Gnetales, Ephedrales and Welwitschiales **(5L)**

REFERENCES :

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2. Arnold A.C. (2005). An Introduction to Paleobotany. Agrobios (India). Jodhpur.
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4. Rashid A. (1999). An Introduction to Pteridophyta. Vikas Publishing House Pvt. Ltd. New Delhi.
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12. Surange K.R. (1966). Indian Fossil Pteridophytes. CSIR., New Delhi.
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18. Chamberlain C.J 1934. Gymnosperms-Structure and Evolution, Chicago.
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21. Maheshwari P. and Vasil, Vimla 1961. *Gnetum*, Delhi.
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Choice Based Credit System Syllabus (2022 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. II) **Subject**: Botany

Course: Plant Systematics II **Course Code**: PSBT 121

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2		3							
CO 3			3						
CO 4	2								
CO 5			2						
CO 6								3	2
CO 7		3							

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Get knowledge about cryptogams to conserve Cryptogamic diversity.

CO4. Get knowledge about life history of algae, fungi bryophytes.

PO2: Critical Thinking and Problem Solving

CO2. Classify the cryptogams up to species level.

CO7. Analyze industrial applications of algae.

PO 3: Social competence

CO5. Explain the role of Algae, Fungi and Bryophytes in human welfare.

CO3. Get aware about the importance of Cryptogams.

PO 8: Environment and Sustainability

CO6. Aware about plant conservation in society.

PO 9: Self-directed and Life-long Learning

CO6. Aware about plant conservation in society.

Class : M. Sc. I (Semester- II)

Paper Code : PSBT 212

Paper : II Title of Paper : Plant Physiology and Biochemistry

Credit : 4 No. of lectures : 60

A) Learning Objectives:

1. To give knowledge of physiological processes which occurs in plants.
2. To make aware about structure and role of biomolecules in plants.

B) Course Outcome:

CO1. Use knowledge for improvement of agricultural yield
CO2. Students aware about the plant to response environmental conditions.
CO3. Students get knowledge of internal activities in plant.
CO4. Development of expertise in plant physiology.
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

Credit -1 (15 Lectures)

Introduction, present status of plant physiology in India and abroad 1L

Photosynthesis 8L

Photosynthetic pigments, absorption and transformation of radiant energy, Light Harvesting complexes, Kok curve, Kautsky curve, Organisation of photosynthetic ETS, photo inhibition O_2 and H_2 evolution, Calvin Cycle and its regulation RUBISCO activity, Photorespiration, CAM, C4 Pathway and its types.

Respiration 6L

EMP pathway, TCA cycle, PPP, Organisation of mitochondrial ETS, Gluconeogenesis, High energy compounds: Synthesis and utilization, ATP synthesis, Cyanide resistance pathway and role of Alternate oxidase, Photorespiratory pathway, Significance of Photorespiration and dark respiration.

Credit -2 (15 Lecture)

Overview of Solute Transport 5L

Uptake, Transport and translocation of water, ions, solutes and macronutrients from soil through cells, across membranes, through xylem and phloem, transpiration, Translocation of photoassimilate, Transport in phloem, Source and Sink relationship, Diffusion, Uniport, Symport, Antiport channels.

Organic acid metabolism 3L

Role and metabolism of oxalic acid, ascorbic acid, malic acid

Stress Physiology **3L**

Response of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses. Mechanism of resistance to biotic stress and tolerance to abiotic stress.

Plant growth regulators **4L**

Biosynthesis and action mechanism of Auxins, Gibberellins (GA), Cytokinins, Ethylene and Abscisic Acid,

Credit -3 (15 Lectures)

Energy Dynamics **3L**

Structure of atoms, molecules and chemical bonds, Principles of thermodynamics, free energy, Redox potentials, Dissociation and associations constants, Activation energy, Binding energy.

Principles of biophysical chemistry **3L**

pH, buffer, reaction kinetics, thermodynamics, colligative properties. Ions and electrical potentials – Nerst and Goldman equations

Enzymology **4L**

General classification of Allosteric mechanism, Isozymes, Factors affecting enzyme activity, Enzyme Kinetics, Michaelis – Menton equation, Competitive, uncompetitive and non competitive inhibition.

Amino acids and proteins **5L**

General classification of amino acids and proteins, Structure, synthesis and properties of amino acids, protein structure (Primary, secondary, tertiary and quaternary), Ramchandran plot.

Credit 4 = (15 Lectures)

Nitrogen metabolism **3L**

Nitrate and ammonium assimilation, Nitrogen uptake, Nodulation (NOD) Factor, root nodulation and nitrogen fixation.

Secondary metabolites **5L**

General classification of Majorpathways, Phenolics (Lignins, tannins) Flavonoids, terpenoids (steroids), Alkaloids, pigments (Carotenoids, Anthocynins)

Carbohydrates metabolism **3L**

General classification, Synthesis and breakdown of carbohydrates (starch,

glycogen, pectin, Glucose)

Lipid metabolism **4L**

General classification of Phospho, Spingo, Glyco lipid, Biosynthesis and breakdown (β -oxidation) of lipid.

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Choice Based Credit System Syllabus (2022 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. II) **Subject**: Botany

Course: Plant Physiology and Biochemistry **Course Code**: PSBT 122

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3	3							
CO 3				3					
CO 4									
CO 5	2			2					
CO 6	3			3					
CO 7	3			3					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Use knowledge for improvement of agricultural yield.
CO3. Students get knowledge of internal activities in plant.
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

PO2: Critical Thinking and Problem Solving

CO2. Students aware about the plant to response environmental conditions.

PO 3: Social competence

CO1. Use knowledge for improvement of agricultural yield.

PO 4: Research-related skills and Scientific temper

CO3. Students get knowledge of internal activities in plant.
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

Class : M. Sc. I (Semester-II)

Paper Code : PSBT 213

Paper :III Title of Paper: Molecular Biology & Genetic Engineering

Credit :4 No. of lectures :60

A) Learning Objectives:

1. To give knowledge about nucleic acid structure, role and synthesis of protein.
2. To make aware about methods required for r-DNA technology.

B) Learning Outcome:

CO1. Experts required in future for genetic library of plants.
CO2.The main outcome of this course is to acquaint students with some cytological techniques.
CO3. Experts required in future for genetic library of plants.
CO4. Acquaint the students with synthesis of nucleic acids and PCR technique.
CO5. Students get knowledge of genetical heredity.
CO6. Students become expertise in Plant Breeding Techniques.
CO7. Get knowledge for improving the new crop variety.

Credit1=(15Lectures)

The structure and function of DNA 6L

a. The importance of technological advances: the Hershey–Chase experiment
b. A model for the structure of DNA: the DNA double helix
c. Primary structure, secondary and tertiary structure of DNA , Alternative forms of DNA (A, B, C, D, Z)

Replication of DNA 4L

a. Principle
b. Modes of replication (Conservative, semiconservative and dispersive)
c. Biochemical mechanism of DNA Replication – Enzymes involved in DNA replication
d. Fidelity of replication
e. Bidirectional and Rolling circle replication

DNA damage and repair 3L

a. Types of DNA Damages
b. DNA repair mechanisms
c. Coping with DNA Damage Without Repairing It
d. Transposition – types of transposons

Credit2=(15Lectures)

Structural organization of Gene 4L

a. Organization and Structure of prokaryotic and eukaryotic genes

Structure and role of promoters, enhancers and terminators,exons and introns.

a. Genetic code **5L**

Transcription RNA synthesis

a. Different types of RNA m-RNA, r-RNA and (t-RNA)
b. Transcription apparatus.
c. RNA polymerases and their role.
d. Transcription in prokaryotes and eukaryotes- Initiation, elongation and termination.
e. RNA processing-RNA editing capping, methylation, polyadenation and splicing

Translation protein synthesis **6L**

a. Translation in prokaryotes and eukaryotes (initiation, elongation and termination)
b. Controlling factors of translation
c. Gene Regulation (Lac operon, trp operon)
d. Translational proof-reading, translational inhibitors, Post- translational modification of proteins

Credit3=(15Lectures)

Molecular gene cloning **6L**

a. Introduction, tools of recombinant DNA technology, Preparation of recombinant DNA,
b. DNA libraries : genomic library, chromosomal library, cDNA library
c. Enzymes used in genetic engineering: Restriction enzymes.

Methods of expressing cloned genes **6L**

a. Plasmids: pUC, pBR etc., Phages: Lambda and T4 phages, Cosmids, BACs and YACs, Shuttle vectors,
b. Ti-plasmids and Ri- plasmids, Plant DNA viruses

Identification of recombinants **3L**

a. PCR principle and applications
b. DNA probes
c. DNA sequencing methods

Credit4=(15Lectures)

Isolation of gene and gene libraries **3L**

a. Techniques of DNA isolation and methods of purification

b. Preparation of cDNA, Genomic DNA library, cDNA libraries

Plant Genetic Engineering **6L**

a. Gene Transfer Methods- direct and indirect gene transfer in plants.

b. *Agrobacterium* mediated Gene transfer methods

c. Screening for transformants

d. Transgenic plants-molecular approaches 2L

Application of genomics and proteomics

a. Concept of genomics and proteomics, Human genome project, objective of proteomics,

b. Methodologies of proteomics(2D gel electrophoresis)

Applicationof GeneticEngineering **4L**

c. Transgenic plants for draught, cold and disease resistance

d. Lignin modification

REFERENCES

1. Lewin B. (2000). Genes VII. Oxford University Press, New York.

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Company, New Delhi.

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Choice Based Credit System Syllabus (2022 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. II) **Subject**: Botany

Course: Molecular Biology and Genetic Engineering **Course Code**: PSBT 123

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1					2				
CO 2						2			
CO 3									
CO 4				3					
CO 5	3								
CO 6									3
CO 7	2								

Justification for the mapping

PO1: Disciplinary Knowledge

CO5. Students get knowledge of genetical heredity.
CO7. Get knowledge for improving the new crop variety.

PO 4: Research-related skills and Scientific temper
CO4. Acquaint the students with synthesis of nucleic acids and PCR technique.

PO5: Trans-disciplinary Knowledge

CO1. Experts required in future for genetic library of plants.

PO6: Personal and Professional Competence

CO2. The main outcome of this course is to acquaint students with some cytological techniques.

PO 9: Self-directed and Life-long Learning

CO6. Students become expertise in Plant Breeding Techniques.

Class : M. Sc. I (Semester- II)

Paper Code : PSBT 214

Paper : IV Title of Paper : Plant Ecology and Biodiversity

Credit : 4 No. of lectures : 60

A) Learning Objectives:

1. To create awareness about the plants and its environment
2. To understand the need for conservation of species and the biodiversity
3. To make aware about the rules and regulations for protection of biodiversity

B) Course Outcome:

CO1. Appreciate the ethical, cross-cultural and historical context of environmental issues and the links between human and natural systems.

CO2. The student can analyse and interpret the plant relation with the environment and impactof human interventions on ecosystem.

CO3. Provide plant description, describe the morphology and reproductive structure of cryptogams.

CO4. Gain the proficiency in the identification of cryptogams.

CO5. Knowledge of comparison between cryptogams and other plant groups.

CO6. Knowledge of scope of the cryptogams diversity.

CO7. Knowledge about habitat conservation of cryptogams diversity.

Credit-1=(15Lectures)

Basic Ecological Concept **6L**

Habitat ecology, synecology, autecology; Ecosystem concept; Structure and functions of biotic and abiotic components; Energy exchange-food chains and food webs, ecological pyramids

Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement

Plant relation with the environment **4L**

Plant interaction with the biotic and abiotic environment (Climatic, edaphic, Hydrological), Plant distribution with respect to topographic factors.

Conservation ecology: **5L**

Principles of conservation, major approaches in management, role of WWF, IUCN, MAB,UNESCO, and UNEP in environmental education

Credit2=(15Lectures)

Population Ecology **7L**

Characteristics of population, population growth curves, factors affecting population size, Life history strategies, r and k selection, C-S-R triangle, Concept of meta population, extinction events.

Community Ecology **4L**

Nature of communities; community structure and attributes; measurement of diversity, Diversity types -alpha, beta, gamma, ecotone and edge effect **4L**

Credit-3=(15Lectures)

Ecosystem Ecology **7L**

Ecosystem: Components and organization; energy flow in ecosystem; mineral cycling (C, N, and P cycle); Ecosystem productivity- primary, secondary, GPP, NPP, structure and functions of some of the ecosystems: terrestrial (forest, grassland, Desert) and aquatic (fresh water, marine, estuarine).

Ecological Succession **3L**

Plant succession: Autogenic and allogenic, mechanism and phases; pioneer, seral and climax communities, primary and secondary succession, Hydroseres, lithoseres, xeroseres and haloseres

Applied Ecology 5L

Environmental pollution its impact (Air, water, soil and noise), global environmental change; Environmental Impact Assessment, Concepts- Carbon sequestration, Global Climate Change, toxicology

Credit4: Biodiversity

Biodiversity: Concept, Scope and definitions, types of biodiversity-genetic diversity, species Diversity, ecosystem diversity 2L

Value and use of biodiversity-

Ethical, aesthetic, food, fodder, ornamentals, medicinal, economical and socio-ecological approach etc. 2L

Loss of biodiversity: Factors affecting diversity, natural verses anthropogenic, loss of biodiversity and its consequences on the human life. Factors affecting loss of genetic diversity, species diversity and ecosystem diversity 4L

Conservation of Biodiversity: 7 L

Indian initiatives in biodiversity conservation- biodiversity act 2002, Biodiversity

Rules 2004, National Biodiversity Strategy and Action Plan (NBSAP), Plant Varieties Protection and Farmer's Rights Act, 2001, National Biodiversity Authority (NBA) etc. Protected Area Network (PAN)- ecological sensitive zone; important protected areas of India,

International program for biodiversity conservation, convention on biological diversity (CBD), CITES, Kyoto Protocol, Ramsar Conventionon WetLands

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Choice Based Credit System Syllabus (2022 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. II) **Subject**: Botany

Course: Plant Ecology and Biodiversity **Course Code**: PSBT 124

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1		3							
CO 2							2		

CO 3	3								
CO 4				2					
CO 5	3								
CO 6	3								
CO 7	3							3	

Justification for the mapping

PO1: Disciplinary Knowledge

CO3. Provide plant description, describe the morphology and reproductive structure of cryptogams.

CO5. Knowledge of comparison between cryptogams and other plant groups.

CO6. Knowledge of scope of the cryptogams diversity.

CO7. Knowledge about habitat conservation of cryptogams diversity.

PO2: Critical Thinking and Problem Solving

CO1. The student can analyse and interpret the plant relation with the environment and impactof human interventions on ecosystem.

PO 4: Research-related skills and Scientific temper

CO4.Gain the proficiency in the identification of cryptogams.

PO 7: Effective Citizenship and Ethics

CO2. Appreciate the ethical, cross-cultural and historical context of environmental issues and the links between human and natural systems.

PO 8: Environment and Sustainability

CO 7. Knowledge about habitat conservation of cryptogams diversity.

Class : M. Sc. I (Semester- II)

Paper Code : PSBT 215

Paper : Practicals based on PSBT 211 and PSBT 212

A) Learning Objectives:

1. To generate awareness on habit of plants with reference to its habitats and conservation of ecology.
2. To train skilled students in physiological and biochemical techniques.

B) Course Outcome:

By the end of course students will be able to

CO1. Develop identification skill in cryptogams.
CO2. Train in cell biology techniques.
CO3. Understand basic knowledge about life cycle of cryptogams.
CO4. Internal and external structure of cryptogams.
CO5. Explain basic knowledge about evolution of lower cryptogams.
CO6. Discuss spore dispersal mechanism.
CO7. Understand variations in cryptogamic diversity.

Practicals Based on Based on PSBT (Any 12 Practicals)

1. Psilopsida: *Psilotum* (1P)
2. Lycoposida and Sphenopsida: *Selaginella, Equisetum, Isoetes* (2P)
3. Pteropsida: *Ophioglossum, Osmunda, Marsilea,* (4P)
4. Fossil Pteridophytes: Any four forms (At least one from each group)(2P)
5. Study of external, internal, reproductive morphology of *Cycas Pinus* (1P)
6. Study of external, internal and reproductive morphology of *Gnetum* (1P)
7. Study of fossil specimens of gymnosperm (any six) from order Pteridospermales, Cycadeoidales and Pentoxylales (1P)

Note: Botanical excursion tour is compulsory to study Pteridophytes and Gymnosperms, submission of tour report and any 10 photographs of Pteridophytes and Gymnosperms of each is mandatory at the time of practical examination.

Practicals Based on PSBT (Any 12 Practicals)

1. Preparation of solution of different concentrations, Buffers, Conductivity and pH Measurements 1P

2. Extraction and estimation of enzyme activity- Catalase/peroxidase 1P

3. Estimation of soluble proteins in germinating seeds by Lowry's method 1P

4. Isolation and estimation of chlorophylls and carotenoids. Separation of pigment using column Chromatography. 2P

5. Estimation of ascorbic acid in ripe and unripe fruits 1P

6. Effect of salt stress on proline accumulation and its estimation 1P

Choice Based Credit System Syllabus (2022 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. II) **Subject**: Botany

Course: Practical based on PSBT 121 and PSBT 122 **Course Code**: PSBT 125

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1		3					3		
CO 2				3					
CO 3	3								
CO 4				2					
CO 5	2								
CO 6	3								
CO 7								2	3

Justification for the mapping

PO1: Disciplinary Knowledge

CO3. Provide plant description, describe the morphology and reproductive structure of cryptogams.

CO5. Knowledge of comparison between cryptogams and other plant groups.

CO6. Knowledge of scope of the cryptogams diversity.

PO2: Critical Thinking and Problem Solving

CO1. Appreciate the ethical, cross-cultural and historical context of environmental issues and the links between human and natural systems.

PO 4: Research-related skills and Scientific temper

CO2. The student can analyse and interpret the plant relation with the environment and impactof human interventions on ecosystem.

CO4. Gain the proficiency in the identification of cryptogams.

PO 7: Effective Citizenship and Ethics

CO1. Appreciate the ethical, cross-cultural and historical context of environmental issues and the links between human and natural systems.

PO 8: Environment and Sustainability

CO7. Knowledge about habitat conservation of cryptogams diversity.

PO 9: Self-directed and Life-long Learning

CO7. Knowledge about habitat conservation of cryptogams diversity.

Class : M. Sc. I (Semester- II)

Paper Code : PSBT 216

Paper : Practicals based on PSBT 213and PSBT 214

A) Learning Objectives:

1. To give hands on training on molecular techniques and analysis of water and soil.
2. To provide the knowledge required for the molecular biologist and ecologist.

B) Course Outcome:

By the end students will be able to of course

CO1. Explain basic cell structure.
CO2. Understand basic biological concepts.
CO3.Get acquainted with some cytological techniques.
CO4. Understand basic knowledge about structure of cell organelles.
CO5. Explain mechanism of cells in plant.
CO6. Train in different isolation techniques in cell organelle.
CO7. Interprets cell structure and their function.

Practical's based on BOT 4203 Molecular Biology and Genetic engineering (Any 12 Practicals)

1. Restriction digestion of plasmid DNA, electrophoresis and molecular weight determination of DNA fragments. 2P
2. Isolation of plant genomic DNA and quantification. 2P
3. Effect of temperature and alkali on absorption of DNA: hyperchromicity 1P
4. Separation of seed storage proteins from leguminous seeds and quantification of each fraction 2P
5. SDS-PAGE separation of seed storage proteins from legumes. Determination of molecular size of the globulin subunits. **3P**

Practicals based on BOT 4204 Plant Ecology and Biodiversity

1. Determination of frequency, density, abundance, dominance of the species among the plant communities using quadrat method **1P**
2. Interpretation of satellite imageries and aerial photographs with respect to major vegetation. **1P**
3. Mapping of vegetation in given area using GPS. 1P
4. Physicochemical analysis of soil - Water holding capacity, Mg, Ca. **2P**
5. Physicochemical analysis of water (clean and polluted): -Hardness, Cl **2P**
6. Biological analysis of water samples (clean and polluted): Phytoplankton 1P
7. Biological analysis of water samples (clean and polluted): DO, CO_2 2P
8. Comparison of stomata index and pollen fertility of the plants from polluted and non-polluted area.

Choice Based Credit System Syllabus (2022 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. II) **Subject**: Botany

Course: Practical based on PSBT 123 and PSBT 124 **Course Code**: PSBT 126

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3								
CO 3						3			
CO 4	2								
CO 5	2								
CO 6									3
CO 7					3				

Justification for the mapping

PO1: Disciplinary Knowledge
CO1. Explain basic cell structure.
CO2. Understand basic biological concepts.
CO4. Understand basic knowledge about structure of cell organelles.
CO5. Explain mechanism of cells in plant.

PO5: Trans-disciplinary Knowledge
CO7. Interprets cell structure and their function.

PO6: Personal and Professional Competence
CO3.Get acquainted with some cytological techniques.

PO 9: Self-directed and Life-long Learning
CO6. Train in different isolation techniques in cell organelle.