Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

Course Structure for M. Sc. I (Botany)

WEF: 2022-23 to 2024-25

Preamble

The curriculum of post graduation in Botany of this autonomous institute is a road map towards achieving excellence in the diverse fields like industry, service, research and academics. The academics framework is designed in tune with national academic professional standard. Also special attention is given to have know how thrust areas, instrumentation acquaintance and skills at par. Surely the student will acquire knowledge, skills and futuristic goals to serve better with responsibility as again knowledge of plants has cone in forefront of 21st century.

Yes we are committed……!

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.

Course Structure for M. Sc. I (Botany)

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

SYLLABUS (CBCS) FOR M. Sc. Botany I (w. e. from June, 2022)

Academic Year 2022-2023

Class : M.Sc. (Semester- I)
Paper Code : PSBT111
Paper : I Title of Paper: Plant Systematics I
Credit : 4 No. of lectures: 60

A) Learning Objectives:

1. To create awareness and need of inculcating knowledge of Cryptogamic diversity.
2. To give idea of applied importance of Cryptogams.

B) Course 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.

TOPICS / CONTENTS:

Unit -1 (22 Lectures) Algae

Systematics and Taxonomy – Principles, outline of classification of algae up to family level according to Fritsch system and Recent developments in algal classification with special emphasis on emerging trends in molecular phylogeny and their relationships **5 L**

Algological studies – Algal habitats, Pigment constitution in algae, Reserve food, Modes of perennation in algae, Origin and evolution of sex, Contribution of algal studies in India and world.(three)…… **4 L**

Cyanophyta – Distinguishing characters, thallus organization, ultra-structure of heterocyst and its significance **2 L**

Chlorophyta- Thallus organization, reproduction – asexual and sexual, diagrammatic life cycle pattern inunicellular, filamentous and multicellular green algae. **4L**

Brief Introduction, Comparative structure and reproduction in Charophyta, Euglenophyta, Xanthophyta, Bacillariophyta and Chrysophyta **4 L**

Phaeophyta and Rhodophyta – External and Internal, reproduction and life cycle

patterns. (any one example)… **2 L**

Applications of algae- Commercial applications of algae - Biofertilizer, Medicine, pollution (Palmer's pollution indices). **1 L**

Unit - 2 (23 Lectures) Fungi

Thallus structure, Nutrition, Cell structure, Hyphal modifications in Fungi.

Classification of fungi as per Ainsworth et al system (1973), Alexopoulus and Mims (1993) Contribution of fungal studies in India and world.(any three). **5 L**

Myxomycotina - Distinguishing characters, types of plasmodium, fruiting bodies and life cycle pattern **3 L**

Mastigomycotina - Distinguishing characters, structure of thallus in Chytridiomycetes and Oomycetes **3 L**.

Zygomycotina - Distinguishing characters, Thallus structure, Heterothallism and sexual reproduction **3 L**.

Ascomycotina-Thallus structure, Fructifications, Comparative study of Hemiascomycetes and Euascomycetes **3 L**.

Basidiomycotina – Distinguishing characters, thallus structure, types and structure of basidia and basidiocarps **2 L**

Deuteromycotina – Distinguishing characters, thallus structure, fructifications, types of conidia, conidial ontogeny. **2 L**

Applications of fungi- Biofertilizers, biocotrol, biopesticides, food, disease and medicine **2 L**

Unit - 3 (15 Lectures) Bryophytes

Introduction, characters, Affinities with thallophytes and pteridophytes, Contributions of bryologists in world and India (any three), Comparative system of classification according to G. M. Smith and R. M. Schster (1972), Origin of Bryophytes, evolution of sporophyte, theory of sterilization and reduction, apogamy and apospory. **4 L**

Distribution, Distinguishing characters, morphology and anatomy of gametophyte and sporophytes of following orders. **10 L**

Takakiales, Calobryales and Sphaerocarpales (3 L Marchantiales (1L), Jungermanniales (1L), Anthocerotales(1L), Sphagnales(1L), Polytrichales(1L), Funariales(1L) Eubryales (1L).

Applications of bryophytes- Indicators of pollution, Conservation and need importance **1 L**.

References:

Algae :

1. **Brodie J. and Lewis J.** (2007). (Ed.) Unravelling the algae: the past, present and future of algal systematics. CRC press, New York, pp 335.
2. **Bellinger E.G. and Sigee D.C.** (2010). Freshwater algae: Identification and use as bioindicators, Willey-Blackwell, UK, pp. 271.
3. **Graham L.E. and Wilcox L.W.** (2000). Algae. Penticce-Hall,Inc, pp. 640
4. **Krishnamurthy V.** (2000). Algae of India and neighboring countries I.Chlorophycota, Oxford & IBH, New Delhi.
5. **Lee R.E.** (2008). Phycology. Cambridge University Press, pp.547.
6. **Prescott G.W.** (1969). The algae.
7. **Smith G.M.** (1950). The fresh water algae of the United States, Mc-graw Hill NewYork.
8. **Vashista B.R, Sinha A.K and Singh V.P.** (2005). Botany for degree students Algae, S. Chand's Publication.
9. Sharma O.P. Algae

Fungi:

1. **Ainsworth, Sussman and Sparrow (1973).** The fungi. Vol IV A & IV B. Academic Press.
2. **Alexopolous C.J., Minms C.W. and Blackwell M.** (1999). (4th edn) IntroductoryMycology. Willey, New York, Alford R.A.
3. **Deacon J.W.** (2006). Fungal Biology (4th Ed.) Blackwell Publishing, ISBN. 1405130660.
4. **Kirk *et al.*** (2001). Dictionary of fungi, 9th edn, Wallingford: CABI, ISBN: 085199377X.
5. **Mehrotra R. S. and Aneja K. R.** (1990). An introduction to mycology. New Age Publishers, ISBN 8122400892.
7. **Webster J. and Rpland W.** (2007). Introduction to fungi (3rd Edn) Cambridge University Press, 978-0-521-80739-5.

Bryophytes:

1. **Chopra R.N. and Kumar P.K.** (1988). Biology of Bryophytes. John Wiley & Sons, New York, NY.
2. **Kashyap S.R.** (1929). Liverworts of the Western Himalayas and the Punjab Plain. Part 1, Chronica Botanica, New Delhi.

4 **Parihar N. S.** (1980). Bryophytes: An Introduction to Embryophyta. Vol I.

Central Book Depot, Allahabad

6. **Prem Puri** (1981). Bryophytes: Morphology, Growth and Differentiation. Atma Ram and Sons, New Delhi.
7. **Udar R.** (1975). Bryology in India. Chronica Botanica, New Delhi.
8. **Udar R.** (1970). Introduction to Bryophytes. Shashidhar Malaviya Prakashan. Lucknow.
9. **Watson E.V.** (1971). Structure and Life of Bryophytes. 3rd Edn. Hutchinson University Library, London.
10. **Vashista B.R., Sinha A.K., Kumar A.** (2008). Botany for degree students – Bryophyta, S.Chands Publication.

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Plant Systematics I **Course Code**: PSBT 111
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	3								
CO 5						3			
CO 6			2						
CO 7	2	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.
CO7. Analyze industrial applications of algae.

PO2: Critical Thinking and Problem Solving

CO2. Classify the cryptogams up to species level.
CO7. Analyze industrial applications of algae.

PO 3: Social competence

CO3. Get aware about the importance of Cryptogams.
CO6. Aware about plant conservation in society.

PO6: Personal and Professional Competence

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

Class : M.Sc. (Semester- I)
Paper Code: PSBT112
Paper : II Title of Paper: Cell Biology
Credit : 4 No. of lectures: 60

A) Learning Objectives:

1. To study structure of cell organelles and their functions.
2. To pertain knowledge of different cytological techniques.

B) Learning Outcome:

By the end of course students will be able to

CO1. Explain the concepts of the cell.
CO2. Understand basic cell structure.
CO3. Describe the structure and function of cell membrane.
CO4. Expert with some cytological techniques.
CO5. Understand current findings in cell biology.
CO6. Demonstrate and explain different phases of cell cycle.
CO7. Get knowledge of different types of cell communication.

TOPICS/CONTENTS:

Credit 1 = (15 Lectures)

Unit 1: Introduction to cell biology, Cell theory and cell structure **1L**

Cell Wall- Biogenesis, Ultra Structure and function, Growth- primary and secondary wall. **2L**

Cell membranes- Molecular organization, Fluid mosaic model, Membrane protein diffusion, Electrical properties of membranes, Transport across membranes-Facilitated diffusion, Carrier and channel proteins, Transporters, Active transport, Transport of ions and solutes **5L**.

Unit 2: Molecular organization and biogenesis of chloroplast and mitochondrial membrane. **2L**

Vacuoles- Biogenesis, transporters, Mechanism of sorting and regulation of intracellular transport, Role as storage organelle, Transport across vacuolar membrane. **2L**

Endoplasmic reticulum- Ultra structure of ER, Role in synthesis and transport of secretary proteins. **2L**

Golgi complex- Ultra structure of golgi complex, Role in sorting, storage and secretion. **1L**

Credit 2 = (15 Lectures)

Unit 1: Nucleus- Structure, Organization and regulation of nuclear pore complex,

Transport across nuclear membrane **2L**

Ribosomes- Structure, Assembly and dissociation of subunits, function **2L**

Lysosomes- Ultra structure of lysosomes, Membrane integrity and role. **2L**

Glyoxysomes - Structure and functions **1L**

Peroxisomes- Structure and functions **1L**

Unit 2: Cytoskeleton- Composition and organization of microtubules, Intermediate filaments, microfilaments, signaling and intracellular traffic, flagella- Structure and organization, Role in motility. **4L**

Techniques in cell biology- In Situ hybridization to locate transcripts in cell types, FISH, GISH, confocal microscopy. **3L**

Credit 3 = (15 Lectures)

Unit 1: Signal transduction-Types of receptors: Ion channel linked receptor, Enzyme linked receptor, G Protein linked receptor. **3L**

Phospholipid signaling, secondary messengers, $Ca^{2+,}$ Calmodulin cascade, regulation of signaling pathways. Diversity in protein kinases and phosphatases, **3L**

Specific signaling mechanisms with suitable examples- Biotic and abiotic stress, ABA induced stomatal closure, Stomatal guard cell signaling **3L**

Unit 2: Nuclear- organelle signaling during plastid development **1L**

Ethylene mediated two component system. **2L**

Cellular communication- general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins and its regulation**.** **3L**

Credit 4 = (15 Lectures)

Unit 1: Cell cycle- Phases of cell cycle, functional importance of each phase, Molecular events during cell cycle, Regulation of cell cycle, Check points, Cyclins and protein kinase, MPF (Maturaton promoting factor). **6L**

Method to study cell cycle- labeled mitotic curve, flow cytometry, use of mutants. **3L**

Unit 2: Cell aging and cell senescence, programmed cell death-moleular aspects, regulation of cell death, PCD in response to stress. **3L**

Apoptosis- Role of different genes, cell organelles during apoptosis, genetic control of apoptosis **3L**

REFERENCES:

1. **Alberts B., Bray D., Lewis J., Raff M., Roberts K., Watson J.D.** (1989). Molecular Biology of the Cell. 2nd Edn. Garlan Publ. Inc. New York.
2. **Karp G.** (1999). Cell and Molecular Biology- Concept and Expts. John Wiley and Scne Ine., USA.
3. **Lodish S., Baltimore B., Bek C., Lawrence K.** (1995).Molecular Cell Biology.

3rd Edn. Scientific American Books, New York.

4. **De Robertis, De Robertis** (1988). Cell and Molecular Biology, 8th Edn. Info-Med, Hongkong.
5. **Buchanan, Grissem and Jones** (2000). Biochemistry and Molecular Biology of Plants. American Soc. Plant Biologists, Waldorf.
6. **Lewin B. (**2000). Gene VII. Oxford University Pres. New York, USA.
7. **De Robertis and De Robertis** (2005). (8th edition) (Indian) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
8. **David S.** (2004) (1st Indian Edition). Cell Biology, New Delhi**.**
9. **Albert et al (**2002). (4th Edn). Molecular Biology of the cell, Garland Science (Taylar and Francis) New York Group (wt)
10. **Lodish et al (**2004). 5th Edn). Molecular Cell Biology, W H Freeman and company, New York.
11. **Arthur G** (1979) (5th Edn). Cell Physiology, Toppan company Ltd., Tokyo, Japan**.**
12. **Verma P.S and Agarwal V.K.** (2006) Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.

Choice Based Credit System Syllabus (2022 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Cell Biology **Course Code**: PSBT 112
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						3			
CO 5	2	3							
CO 6				3					
CO 7				2					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Explain the concepts of the cell.
CO2. Understand basic cell structure.
CO3. Describe the structure and function of cell membrane.
CO5. Understand current findings in cell biology.

PO2: Critical Thinking and Problem Solving

CO5. Understand current findings in cell biology.

PO 4: Research-related skills and Scientific temper

CO6. Demonstrate and explain different phases of cell cycle.
CO7. Get knowledge of different types of cell communication.

PO6: Personal and Professional Competence

CO4. Expert with some cytological techniques.

Class : M.Sc. (Semester- I)
Paper Code : PSBT113
Paper : III Title of Paper: Genetics and plant Breeding
Credit : 4 No. of lectures: 60

A) Learning Objectives:

1. To study genetic inheritance and gene interactions in plants.
2. To make aware about plant breeding

B) Learning Outcome:

By the end of course students will be able to

CO1. Know applications of gene interactions.
CO2. Use breeding techniques in field on plants.
CO3. Expert in evaluation of conclusions based on genetic data.
CO4. Get knowledge about gene expression and regulation of gene.
CO5. Demonstrate emasculation and pollination methods.
CO6. Explain floral biology for breeding techniques.
CO7. Demonstrate mutation in plant cells.

Credit 1 = INHERITANCE OF GENES :(15 Lectures)

Unit 1: Principles of Mendelian inheritance and Interaction of genes:- 6L

Mendel's Laws - Dominance, Segregation, Independent assortment, Interaction of genes- Complementary, epitasis, inhibitory, polymeric and additive. Extensions of Mendelian principles: Phenocopy, Pleiotropy

Unit 2 : Cytoplasmic inheritance:- 3L

Mitochondrial chloroplast genomes, Inheritance of chloroplast genes (*Mirabilis jalapa*), Inheritance of mitochondria genes (Petit yeasts), Cytoplasmic male sterility in Maize), Interaction between nuclear and cytoplasmic genes

Unit 3: Inheritance: Quantitative and Sex linked 6L

Quantitative traits, Inheritance of quantitative traits, Polygenic traits :corolla length in *Nicotiana*, Cob length in *Zea mays,* Heritability and its measurement

Chromosomal theory of inheritance: Inheritance of X and Y linked genes, Sex limited and sex influenced genes.

Credit 2 = ALLELE, LINKAGE ANDRECOMBINATIONS :(15 Lectures)

Unit 1: Concept of gene, allele, multiple allele, pseudo allele, Complementation test **4L**

Unit 2: Hardy Weinberg's Law, Factors affecting gene and gene frequencies,
Pedigree analysis in Human genetics, Genomic Imprinting **4L**

Unit 3: Linkage and Recombination in Chromosomes: homologous, non-homologous, site specific recombination, Linkage maps, LOD score for linkage testing, Tetrad analysis in

Yeast (unordered), *Neurospora* (ordered) **7L**

Credit 3 = MICROBIAL GENETICS AND CYTOGENETICS: (15 Lectures)

Unit 1: Methods of genetic transfers- transformation, conjugation and transduction in bacteria, Genetic recombination in Bacteria **4L**

Unit 2: Lytic and lysogenic cycles in phages, Genetic recombination, specialized transduction ,Mapping the bacteriophage genome **4L**

Unit 3: Structure, Organization of chromosome, Concept of karyotope, Preparation of chromosome for Karyotype, Chromosomal alterations **:**Deletion, duplication, inversion, translocation, complex translocations, Robert sonian and BA translocations **7L**

Credit 4 = PLANT BREEDING: (15 Lectures)

Unit 1: Centers of origin, distribution and areas of diversity, Importance of genetic diversity in crop improvement, Importance of genetic diversity in conservation and regulation. **3L**

Unit 2: Cross and self pollination, Pollination control mechanisms and implications, Selection methods in self pollinated and cross pollinated, asexually, propagated crops, Marker Assisted selection in plants, Hybridization and its role in crop improvement, Inter-varietal and wide/distant Crosses **9L**

Unit 3: Physical and chemical mutagens, General method of induction of mutations in crop plant, Role of induced mutations, Induction of polyploidy in crop plants, Role of polyploidy in plant breeding **3L**

REFERENCES: -

1. **Hartk D.L and Jones, E.W** 1998 Genetics: Principles and Analysis (Fourth Edition). Jones and Bartlett Publishers, Massachusetts, USA.
2. **Lewin, B.** 2000. Gene VII. Oxford University Press, New York, USA.
3. **Snustad, D.P and Simmons, M.J** 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc., USA.
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Mumbai.

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10. **Sharma J.R** 1994 Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers Company Ltd., New Delhi.
11. **Singh B.D** 1996 Plant Breeding – Principles and methods. Kalyani Publications, Ludhiana.
12. **Chahal G.S** and Gosal S.S 2002. Principles and procedures of Plant Breeding, Narosa Publishing House, New Delhi.
13. **Verma and Agarwal**, Genetics, S. Chand Co, New Delhi.
14. **Toun N and TrempyJanire**2004 (First Indian Reprint). Fundamental Bacteial Genetics. Blackwell Publishing Co.
15. **Singh B.D** 2004. Genetics. Kalyani Publication, Ludhiana. 26. **Gupta P.K** Genetics and Cytogenetics, Rastogi Publications.

Choice Based Credit System Syllabus (2022 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Genetics and Plant Breeding **Course Code**: PSBT 113
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	2		3						2
CO 3				3					
CO 4	3								
CO 5						2			
CO 6	2					3			
CO 7	3								

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Know applications of gene interactions.
CO2. Use breeding techniques in field on plants.
CO4. Get knowledge about gene expression and regulation of gene.
CO6. Explain floral biology for breeding techniques.
CO7. Demonstrate mutation in plant cells.

PO2: Critical Thinking and Problem Solving

CO1. Know applications of gene interactions.

PO 3: Social competence

CO2. Use breeding techniques in field on plants.

PO 4: Research-related skills and Scientific temper

CO3. Expert in evaluation of conclusions based on genetic data.

PO6: Personal and Professional Competence

CO5. Demonstrate emasculation and pollination methods.

CO6. Explain floral biology for breeding techniques.

PO 8: Environment and Sustainability

CO2. Use breeding techniques in field on plants.

PO 9: Self-directed and Life-long Learning

CO2. Use breeding techniques in field on plants.

Class : M.Sc. (Semester- I)
Paper Code : PSBT 114
Paper : IV Title of Paper : Advanced Botanical techniques
Credit : 4 No. of lectures: 60

A) Learning Objectives:

1. To train the students in instrumentation useful in research methodology.
2. To make technosavy students.

B) Learning Outcome:

By the end of course students will be able to

CO1. Get acquainted in advance botanical techniques.
CO2. Understand different types and working of microscopes.
CO3. Students' expertise in microscopic techniques.
CO4. Expertise in different centrifugation techniques.
CO5. Train to use different electrochemical techniques.
CO6.Understand DNA sequencing techniques.
CO7. Analyze antigen –antibody interaction.

TOPICS/CONTENTS:

Credit 1 = (15 Lectures)

Image formation (properties of light), Lens- refraction, magnification concept, resolution concept. Light microscopy, Confocal microscopy, Phase Contrast microscopy, Fluorescence microscopy, Electron microscopy (SEM and TEM), Flow Cytometry **8L**

Microtomy- serial sectioning, double or multiple staining, Lesser assisted Microtomy **4L**

Histochemical and cytochemical techniques- Localization of specific Compounds/ reactions/ activities in tissues and cells **3L**

Credit 2 = (15 Lectures)

Chromatography techniques:-

Introduction, concept of partition coefficient, Column, Gel filtration, Affinity, Ion exchange, HPLC and HPTLC, Gas chromatography (Principle, method and applications of each) **8L**

Eletrophoretic techniques:-

History, Principles, Agarose gel electrophoresis (AGE), Pulsed Field Gel Electrophoresis, Polyacrylamide Gel Electrophoresis (PFGE), Sodium Dodecyl Sulphate polyacrylamide gel electrophoresis (SDS-PAGE/ Denaturing), Isoelctric focusing, 2 Dimensional Gel Electrophoresis (2-D method) **7L**

Credit 3 = (15 Lectures)

Spectroscopic techniques:-

General principles, Beer and Lambert's Law, Molar extinction coefficient, Spectrophotometer (working and application), UV-Visible spectroscopy, Nuclear Magnetic Resonance (NMR) spectroscopy, X-ray crystallography, Spectoflurometry, AAS, MS, IR Spectroscopy **9L**

Radioactive techniques:-

Radioisotopes used in biology and their properties, Units of radioactivity, Interaction of radioactivity with matter, Detection and measurement of radioactivity, Autoradiography, Safe handling of radio isotopes, Non-Radio labeled techniques, Green Fluorescent Proteins, Incorporation of radioisotopes in biological tissues and cells, Molecular imaging of radioactive material. **6L**

Credit 4 = (15 Lectures)

Centrifugation techniques:-

Principles, Types (Analytical and Preparative), Rotors and their types, Ultra centrifugation, Density Gradient Centrifugation, High speed centrifuges **4L**

Electrochemical techniques:-

Electrical conductivity, pH meter, Oxygen electrode **2L**

Immunological techniques:-

Principles, Antigen–antibody interaction, Immuno diffusion, Immuno precipitation, Radio-immuno assay, Rocket immuno-electrophoresis, ELISA, In-Situ localization by techniques such as FISH and GISH. **4L**

Molecular biology techniques:-

DNA sequencing techniques- Sanger's method, Maxam- Gilbert's mehod, Automated DNA sequencing, Pyrosequencing, Sequencing of proteins, Different types of PCR, DNA microarray, Gene delivery, Yeast two hybrid, Protein crystallography **5L**

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1. **P. Gunadegaram** (1995). Laboratory Manual in Microbiology. New Age International (P) Ltd.
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Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Advanced Botanical Techniques **Course Code**: PSBT 114
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						3			
CO 5									3
CO 6	2				2				
CO 7	2				3				

Justification for the mapping

PO1: Disciplinary Knowledge

CO1.Get acquainted in advance botanical techniques.
CO2. Understand different types and working of microscopes.
CO6. Understand DNA sequencing techniques.
CO7. Analyze antigen –antibody interaction.

PO 4: Research-related skills and Scientific temper

CO1.Get acquainted in advance botanical techniques.

PO5: Trans-disciplinary Knowledge

CO6.Understand DNA sequencing techniques.
CO7. Analyze antigen-antibody interaction.

PO6: Personal and Professional Competence

CO3. Students' expertise in microscopic techniques.
CO4. Expertise in different centrifugation techniques.

PO 9: Self-directed and Life-long Learning

CO5. Train to use different electrochemical techniques.

Class : M.Sc. (Semester- I)
Paper Code: PSBT115
Paper : I Title of Paper : Practical's based on **PSBT111 and 112**
Credit : 4 No. of lectures: 60

A) Learning Objectives:

1. To study Cryptogamic habit and habitat diversity.
2. Hand on training for the identification and study of methods of reproduction of cryptogams and ultrastructure of cell organelles.

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.

TOPICS/CONTENTS:

Practical's based on PSBT111

Practical's on Algae: (Any Two Practical's)

Morphological observations, documentation (description and illustrations) and classification according to Fritsch (1935) with reasons of taxa belonging to:

1 **Cyanophyta** and **Chlorophyta**: Any one form. **1P**

2 **Charophyta** and **Phaeophyta** any one form **Rhodophyta**: Any one form. **1P**

Practical's on Fungi: (Any Two Practical's)

Study of the representative genera belonging to following sub-divisions of fungi with respect to vegetative, reproductive structures and classification with reasons according to Ainsworth (1973).

1 Sub-division: **Myxomycotina** ; **Mastigomycotina**: Any one form.

Sub-division: **Zygomycotina** ; **Ascomycotina** : Any one form. **1P**

2 Sub-division: **Basidiomycotina** ; Any one form.

Sub-division: **Deuteromycotina :** Any one form. **1P**

Practicals on Bryophytes: (Any Two Practical's)

Morphological, anatomical and reproductive studies of the following members:

Classification with according to G. M. Smith (1972)

1 **Marchantiophta** : *Plagiochasma* and *Targionia* **1P**

Anthoceratophyta: *Anthoceros*

1. **Bryophyta** : *Polytrichum* and *Funaria* **1P**

Note: Excursion tour arranging for to study cryptogamic diversity.

Practical's based on PSBT112: Cell Biology

1. Differential centrifugation for isolation of cell fractions- Nuclear fraction **1P**
2. Isolation of Chloroplasts to study Hill reaction to measure intactness **1P**
3. Isolation of mitochondria for: Estimation of succinic dehydrogenase activity **1P**
4. Isolation of Lysosomal fraction and estimation of acid phosphatase activity **1P**
5. Study of Electron Micrographs of cell organelles **1P**
6. Cytochemical / Histochemical studies of special cell types: guard cells, senescent cells, bundle sheath cells, meristematic cells, laticiferous cells, glandular cells, Pollen grains, stigma **1P**

Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Practical based on PSBT 111 and PSBT 112 **Course Code**: PSBT 115
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	3								
CO 5									
CO 6	2	3	3		2				
CO 7		2							

Justification for the mapping

PO1: Disciplinary Knowledge

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.

PO2: Critical Thinking and Problem Solving

CO6. Discuss spore dispersal mechanism.

CO7. Understand variations in cryptogamic diversity.

PO 3: Social competence

CO6. Discuss spore dispersal mechanism.

PO 4: Research-related skills and Scientific temper

CO1. Develop identification skill in cryptogams.

PO5: Trans-disciplinary Knowledge

CO6. Discuss spore dispersal mechanism.

Class : M.Sc. (Semester- I)
Paper Code : PSBT116
Paper : I Title of Paper : Practical's based on PSBT113 and PSBT114
Credit : 4 No. of lectures: 60

A) Learning Objectives:

1. To pertain cytological and botanical techniques.
2. To provide the knowledge of different genetic interaction and plant breeding techniques.

B) Course Outcome:

By the end of course students will be able to

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.

TOPICS/CONTENTS:

Practicals based on PSBT113 Genetics and Plant Breeding (Any 12 Practicals)

1. Preparation of stains, Fixatives, Preservatives and pretreatments to plant material 1P

2. Karyotype analysis, preparation of somatic C- metaphase chromosomes of appropriate material using camera lucida drawing and Karyotype analysis in *Allium* / Aloe. 2P

3. Study of meiotic configuration in maize/ *Allium*, *Rhoeo*/ Aloe, *Tradescantia* (prophase I, Chiasma analysis). 2P

4. Induction of mutation in plant material using suitable mutagen 1P

5. Study of Polygenic inheritance. 1P

6. Problems of Mendelian inheritance and estimation of gene frequencies and heterozygotic Frequencies, population genetics and Linkage. 1P

7. *Neurospora* tetrad analysis. 1P

8. Study of *Drosophilla* sexual dimorphism and mutants 1P

9. Linear differentiation of chromosomes through banding techniques such as C-Banding, Banding and Q-Banding. 2P

10. Penetrance and expressivity of PTC testing ability in humans and tonge rollers/non Rollers 1P

11. Floral Biology, Study of Pollen Viability, germination in vitro and staining (any two major crops) 1P

12. Study of monohybrid and dihybrid cross and interactions. 1P

13. Use of Colchicine for induction of polyploidy in appropriate plant material. 2P

14. Conventional Plant breeding techniques (Emasculation) 1P

Practical's based on PSBT114: Botanical Techniques (Any 12 practicals)

1. Study of Binocular microscope **1P**

2. Micrometry and Camera Lucida **2P**

3. Maceration technique **1P**

4. Electrical conductivity and pH measurements **1P**

5. Absorption spectra of BSA/DNA & determination of absorption maxima **2P**

6. Gel filtration **1P**

7. Rocket immunoelectrophoresis **1P**

8. Detection of secondary metabolites by using HPLC **2P**

9. Separation of isozymes by native polyacrylamide gel electrophoresis **2P**

12. Detection of Radioactivity by using GM Counter **2P**

13. PCR **2P**

14. Determination of heavy metals / Minerals by AAS **2P**

Choice Based Credit System Syllabus (2022 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Practical based on PSBT 113 and PSBT 114 **Course Code**: PSBT 116
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.