Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Two Year Degree Program in Botany

(Faculty of Science & Technology)

CBCS Syllabus

M.Sc. (Botany) Part-I Semester -I

For Department of Botany

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

Title of the Programme: M.Sc. (Botany)

Preamble

AES's Tuljaram Chaturchand College of Arts, Science and Commerce (Autonomous) has made the decision to change the syllabi of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Botany and related subjects, the Board of Studies in Botany at Tuljaram Chaturchand College of Arts, Science and Commerce (Autonomous), Baramati - Pune, has developed the curriculum for the first semester of F.Y. B.Sc. Botany which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

A Botany Post Graduates degree equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Post Graduates in Botany find opportunities in various fields, including urban planning, teaching, environmental science, all plant sciences, Bioinformatics, Genetic Engineering, Biostatistics, Plant Biotechnology,

Database analysis, Organic farming, nursery management, entrepreneurship mushroom cultivation, Plant physiology, Bryology, Taxonomy, Ethnobotany, plant tissue culture method and many other domains. Throughout their Two-year degree program, students explore the significance of plant in life of each and every living organism on Earth. They learn tool, techniques, process which is required to set up agencies including pickles, jam, and jelly medicinal plant, fruit processing, vegetable processing, organic product, organic fertilizer and pesticides producing industries also the can earn the knowledge to produce natural remedies for varies diseases. They became expert in discovery and development of many new therapeutic compounds which can be used in pharmaceutical herbal cosmetics and other cosmetic based industries.

Overall, revising the Botany syllabi in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

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.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Botany

Sr. No.	Name	Designation
1.	Prof. Dr. Bhagwan Mali	Chairman
2.	Prof. Dr. Mahadev Kanade	Member
3.	Prof. Dr. Ajit Telave	Member
4.	Dr. Rupali Chitale	Member
5.	Dr. Madhuri Patil	Member
6.	Mr. Sauraj N. Torane	Member
7.	Ms. Ashwini B. Dudhal	Member
8.	Mr. Prasad J. Bankar	Member
9.	Mr. Sourabh R. Chandankar	Member
10.	Prof. Dr. B. M. Gaykar	Expert from SPPU, Pune
11.	Prof. D. K. Gaikwad	Expert from other university
12.	Dr. Jay Chavan	Expert from other university
13.	Dr. S. Gurumurthy	Expert from allied area
14.	Mr. Gore Nitin Anil	Meritorious Student
15.	Ms. Ligade Komal Sambhaji	Meritorious Student
16.	Mr. Zodage Ram Sanjay	Meritorious Student
17.	Ms. Gargade Rutuja Hanumant	Meritorious Student

Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

(Autonomous)

Course Structure for M. Sc. I (Botany)

(CBCS as per NEP 2020)

WEF: June 2023

Sem.	Course Type	Course Code	Course Title	Theory/ Practical	No. of Credits
I	Major (Mandatory)	BOT -501-MJM	Plant Systematics-I	Theory	4
	Major (Mandatory)	BOT -502-MJM	Cell Biology	Theory	4
	Major (Mandatory)	BOT -503-MJM	Botany Laboratory-I	Practical	2
	Major (Mandatory)	BOT -504-MJM	Botany laboratory –II	Practical	2
	Minor (Elective)	BOT -511-MJE(A)	Genetics and Plant breeding	Theory	4
		BOT -511-MJE(B)	Advanced Botanical Techniques	Theory	
	Research Methodology (RM)	BOT -521-RM	Research Methodology	Theory	4
	Total Credits Sem. I				**20**
II	Major (Mandatory)	BOT -551-MJM	Plant Systematics II	Theory	4
	Major (Mandatory)	BOT -552-MJM	Plant physiology and Biochemistry	Theory	4
	Major (Mandatory)	BOT -553-MJM	Botany laboratory -I	Practical	2
	Major (Mandatory)	BOT -554-MJM	Botany Laboratory –II	Practical	2
	Minor (Elective)	BOT -561-MJE(A)	Molecular Biology and Genetic Engineering	Theory	4
		BOT -561-MJE(B)	Plant Ecology and Biodiversity	Theory	4
	On Job Training (OJT)/Field Project (FP)	BOT -581- OJT/FP	On Job Training Field Project	Training /Project	4
	Total Credits Sem. II				**20**
	Cumulative credits Sem I and II				**40**

SYLLABUS (CBCS as per NEP 2020) FOR M. Sc. I Botany
(w. e. from June, 2023)

Name of the Programme : M.Sc. Botany
Program Code : PSBOT
Class : M.Sc.
Semester : I
Course Type : Mandatory Theory
Course Name : Plant Systematics I
Course Code : **BOT -501-MJM**
No. of Lectures : 60
No. of Credits : 04

A) Course objectives:

1. To create awareness and need of inculcating knowledge of Cryptogamic diversity.
2. To give an idea about classification of cryptogams up to species level.
3. To give an idea of applied importance of Cryptogams.
4. To give general account of thallus organization, reproduction and life history of algae, fungi bryophytes.
5. To impart knowledge of plants of lower groups and their uses in wellbeing of mankind
6. To create the awareness of plant conservation in society.
7. To impart the knowledge commercial applications of algae in industry.

B) Course outcomes:

CO1. Student will get knowledge about cryptogams to conserve Cryptogamic diversity.
CO2. Student will be able to classify the cryptogams up to species level.
CO3. Students get aware about the importance of Cryptogams.
CO4. Students get knowledge about life history of algae, fungi bryophytes.
CO5. The students should be able to explain the role of Algae, Fungi and Bryophytes in human welfare.
CO6. Students will be aware of plant conservation in society.
CO7. Students get knowledge about industrial applications of algae.

UNIT -1 **(22L)**

1.1 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. 5L

1.2 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. (Any three scientist) 4L

1.3 Cyanophyta : Distinguishing characters, thallus organization, ultra-structure of heterocyst and its significance. 2L

1.4 Chlorophyta: Thallus organization, reproduction – asexual and sexual,

diagrammatic life cycle in unicellular, filamentous, multi-cellular green algae. 4L

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

1.5 Phaeophyta and Rhodophyta : External and Internal, reproduction and life cycle patterns. (any one example of each) 2L

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

UNIT - 2 **(23L)**

2.1 Fungi : Thallus structure, Nutrition, Cell structure, Hyphal modifications in Fungi. Classification system of fungi as per Ainsworth *et al.* (1973), Contribution of fungal studies in India and world. (Any three scientist) 5L

2.2 Myxomycotina : Distinguishing characters, types of plasmodium, fruiting bodies and life cycle pattern 3L

2.3 Mastigomycotina : Distinguishing characters, structure of thallus in Chytridiomycetes and Oomycetes. 3L

2.4 Zygomycotina : Distinguishing charactrs, Thallus structure, Heterothallism and sexual reproduction. 3L

2.5 Ascomycotina: Thallus structure, Fructifications, Comparative study of Hemiascomycetes and Euascomycetes 3L

2.6 Basidiomycotina : Distinguishing characters, thallus structure, types and structure of basidia and basidiocarps 2L

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

2.8 Applications of fungi: Biofertilizers, biocotrol, biopesticides, food, medicine 2L

UNIT - 3 (15L)

3.1 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. Schuster (1972), Origin of Bryophytes, evolution of sporophyte, theory of sterilization and reduction, apogamy and apospory. 4L

3.2 Distribution, Distinguishing characters, morphology and anatomy of gametophyte and

sporophytes of following orders: Takakiales, Calobryales and Sphaerocarpales Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Polytrichales, Funariales, Eubryales. **10L**

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

References:

1. Ainsworth, Sussman and Sparrow (1973): The fungi. Vol IV A & IV B. Academic Press.
2. Alexopolous C. J., Mims C.W. and Blackwell M. (1999): Introductory Mycology. Willey, New York.
3. Bellinger E. G. and Sigee D. C. (2010): Freshwater algae: Identification and use as bioindicators, Willey-Blackwell, UK.
4. Brodie J. and Lewis J. (2007): (Ed.) Unraveling the algae: the past, present and future of algal Systematics. CRC press, New York.
5. Chopra R. N. and Kumar P.K. (1988): Biology of Bryophytes. John Wiley & Sons, New York, NY.
6. Deacon J. W. (2006): Fungal Biology (4th Ed.) Blackwell Publishing, ISBN. 1405130660.
7. Graham L.E. and Wilcox L.W. (2000): Algae. Penticce-Hall.
8. Kashyap S. R. (1929): Liverworts of the Western Himalayas and the Punjab Plain. Part 1, Chronica Botanica, New Delhi.
9. Krishnamurthy V. (2000): Algae of India and neighboring countries I. Chlorophycota, Oxford & IBH, New Delhi.
10. Lee R. E. (2008): Phycology. Cambridge University Press.
11. Mehrotra R.S. and Aneja K.R. (1990): An introduction to mycology. New Age Publishers, ISBN 8122400892
12. Parihar N.S. (1980): Bryophytes: An Introduction to Embryophyta. VolI. Central Book Depot, Allahabad
13. Prem Puri (1981): Bryophytes: Morphology, Growth and Differentiation. Atma Ram and Sons, NewDelhi.
14. Prescott G. W. (1969): The algae.
15. Smith G. M. (1950): The fresh water algae of the United States, Mc-graw Hill New York.
16. Udar R. (1970): Introduction to Bryophytes. Shashidhar Malaviya Prakashan. Lucknow.
17. Udar R. (1975) : Bryology in India. Chronica Botanica, NewDelhi.
18. Vashista B. R., Sinha A. K., Kumar A. (2008): Botany for degree students– Bryophyta, S. Chand Publication.
19. Vashista B.R, Sinha A.K and Singh V.P. (2005): Botany for degree students Algae, S. Chand Publication.
20. Watson E. V. (1971): Structure and Life of Bryophytes. 3rd Edn. Hutchinson University Library,London.
21. Webster J. and Roland W. (2007): Introduction to fungi (3rd Edn)Cambridge UniversityPress,978-0-521-80739-5.

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Plant Systematics I **Course Code**: BOT -501-MJM
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.

Name of the Programme **:** M.Sc.
Subject : Botany
Program Code **: PSBOT**
Class **:** M.Sc. I
Semester **:** I
Course Type **:** Mandatory Theory
Course Name **:** Cell Biology and Cell signaling
Course Code **: BOT – 502 - MJM**
No. of Lectures **:** 60
No. of Credits **:** 04

A) Course objectives:

1. To introduce various aspect of Cell biology to the students.
2. To study structure of cell organelles and their functions.
3. To study structure and function of cell membrane.
4. To impart the knowledge of modern techniques in cell Biology.
5. To motivate the students in applied aspects of cell biology.
6. To inculcate the knowledge about cell cycle in plants.
7. To understand the general principles of cell communication.

B) Course outcomes:

CO1. The students should be able to explain the concepts of the cell.
CO2. Students will be able explain basic cell structure.
CO3. Students able to describe the structure and function of cell membrane.
CO4. Students are able to expert with some cytological techniques.
CO5. The students should be able to understand current findings in cell biology.
CO6. The students are able to explain different phases of cell cycle.
CO7. The students get knowledge of different types of cell communication.

UNIT 1: **(15L)**

1.1 Introduction to cell biology, Cell theory and cell structure. Cell Wall- Biogenesis, Ultra Structure and function, Growth- primary and secondary wall. 3L

1.2 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

1.3 Molecular organization and biogenesis of chloroplast and mitochondrial membrane. 2L

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

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

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

UNIT 2 **(15 L)**

2.1 **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

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

2.3 **Techniques in cell biology:** In Situ-hybridization to locate transcripts in cell types, FISH, GISH and Confocal Microscopy. 3L

UNIT 3 (15L)

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

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

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

3.4 Nuclear- organelle signaling during plastid development. 1L

Ethylene mediated two component system. 2L

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

UNIT 4 **(15L)**

4.1 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 (Maturation promoting factor). 6L

4.2 Method to study cell cycle -labeled mitotic curve, flow cytometry. 3L

4.3 Cell ageing and cell senescence, programmed cell death-molecular aspects, regulation of cell death, PCD in response to stress. 3L

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

REFERENCES:

1. Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
2. Buchanan, Grissem and Jones (2000): Biochemistry and Molecular Biology of
3. David S. (2004): (1st Indian Edition). Cell Biology, New Delhi.
4. De Robertis and De Robertis (2005): (8th edition) (Indian) Cell and Molecular
5. Earnshaw, W. C., Pollard, T. D., Lippincott-Schwartz, J., Johnson, G. (2016):Cell Biology E-Book. United States: Elsevier Health Sciences.
6. Lewin B. (2000): Gene VII. Oxford University Pres. New York, USA.
7. Pawar C.B. (2015): Cell Biology Himalaya Publishing House.
   Plants.American Soc. Plant Biologists, Waldorf.
8. Verma P.S. & Agarwal V.K. (2022): Cell Biology (Cytology, Biomolecules and Molecular Biology). India: S CHAND & Company Limited.
9. Verma P.S. & Agarwal V.K. (2022): Cell Biology (Cytology, Biomolecules and Molecular Biology) S. CHAND & Company Limited.

Choice Based Credit System Syllabus (2023 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Cell Biology and Cell Signaling **Course Code:** BOT – 502 -MJM
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.

Name of the Programme	**:** M.Sc.
Subject	: Botany
Program Code	**:** PSBOT
Class	**:** M.Sc. I
Semester	**:** I
Course Type	**:** Mandatory Practical.
Course Name	**:** Botany Laboratory- I
Course Code	**: BOT -503-MJM**
No. of Lectures	**:** 60
No. of Credits	**:** 02

A) Course 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.
3. To introduce basic knowledge of structure, forms of lower cryptogams.
4. To study morphology and reproduction in cryptogams.
5. To provide the basic knowledge of thallus, reproduction and evolution of cryptogams.
6. To understand knowledge of spore dispersal mechanism of bryophyte.
7. To understand Cryptogamic diversity.

B) Course outcomes:

CO1. Developed skilled cryptogamist.
CO2. Student will train in cell biology techniques.
CO3. Students get basic knowledge about life cycle of cryptogams.
CO4. Students get better understand structure of cryptogams.
CO5. Students get basic knowledge about evolution of lower cryptogams.
CO6. Students will understand spore dispersal mechanism.
CO7. Students well understand variations in cryptogamic diversity.

Practicals

Morphological observations, description and illustrations of following forms

1. **Cyanophyta**: Any one form from each. 1P
2. **Chlorophyta**: Any one form from each. 1P
3. **Charophyta:** Any one form from each. 1P
4. **Phaeophyta:** Any one form from each. 1P
5. **Rhodophyta**: Any one form from each. 1P
6. **Myxomycotina**: Any one form from each. 1P
7. **Mastigomycotina**: Anyone form for each. 1P
8. **Zygomycotina:** Any one form from each. 1P
9. **Ascomycotina** : Any one form from each. 1P
10. **Basidiomycotina:** Any one form from each. 1P
11. **Deuteromycotina:** Any one form from each 1P
12. **Marchantiophyta** : Any one form from each 1P
13. **Anthoceratophyta**: Any one form from each 1P
14. **Bryophyta** : Any one form from each 1P
15. Excursion tour for study of Cryptogamic Diversity.(Mandatory submission of tour report). 1P

Choice Based Credit System Syllabus (2023 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Botany Laboratory - I **Course Code:** BOT -503-MJM
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	3								
CO 5	3								
CO 6	3		3						
CO 7					3				

Justification for the mapping

PO1: Disciplinary Knowledge

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.

PO2: Critical Thinking and Problem Solving

CO2. Train in cell biology techniques.

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

CO7. Understand variations in cryptogamic diversity.

Name of the Programme : **M.Sc.**
Subject : Botany
Program Code **:** PSBOT
Class **:** M.Sc. I
Semester **:** I
Course Type **:** Mandatory Practical.
Course Name **:** Botany Laboratory- II
Course Code **: BOT -504-MJM**
No. of Lectures **:** 60
No. of Credits **:** 02

A) Course objectives:

1. To study structure of cell organelles and their functions.
2. To know basic biology and theoretical concepts.
3. To pertain knowledge of different cytological techniques.
4. To study structure of basic components of cell organelles.
5. To study the working of cells in plants.
6. To understand cytoplasmic streaming in eukaryotic cell.
7. To give practical knowledge about cell and cell organelles.

B) Course outcomes:

CO1. Students will explain basic cell structure.
CO2. Students able to understand basic biological concepts.
CO3. Students will be acquainting with some cytological techniques.
CO4. Students will get basic knowledge about structure of cell organelles.
CO5. Students able to explain mechanism of cells in plant.
CO6. Students will knowledge about eukaryotic cell.
CO7. Students get practical knowledge about cell organelles.

Practical's based on PSBTMP 114: Cell Biology

1. Differential centrifugation for isolation of cell fractions. 1P
2. Differential centrifugation for isolation of Nuclear fraction 1P
3. Isolation of Chloroplasts to study Hill reaction to measure intactness 1P
4. Isolation of mitochondria for: Estimation of succinic dehydrogenase activity 1P
5. Isolation of Lysosomal fraction. 1P
6. Estimation of acid phosphatase activity 1P
7. Study of Electron Micrographs of cell organelles 1P
8. Cytochemical / Histochemical studies of special cell types: guard cells, senescent cells. 1P
9. Cytochemical / Histochemical studies of special cell types: bundle sheath cells, meristematic cells. 1P
10. Cytochemical / Histochemical studies of special cell types: lactiferous cells, glandular cells 1P
11. Cytochemical / Histochemical studies of special cell types: Pollen grains, stigma. 1P
12. Study of mitotic index of onion root tips. 1P
13. Estimation of chrorophylls in normal and senescent leaves. 1P
14. Effect of abiotic factors on stomatal response. 1P
15. Interpretation of cell cycle. 1P

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Botany Laboratory - II **Course Code:** BOT -504-MJM
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								
CO 6		2							
CO 7	2								

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.
CO7. Interprets cell structure and their function.

PO 4: Research-related skills and Scientific temper

CO3.Get acquainted with some cytological techniques.
CO6. Train in different isolation techniques in cell organelle.

Name of the Programme : M.Sc.
Subject : Botany
Program Code : PSBOT
Class : M.Sc. I
Semester : I
Course Type : Elective Theory
Course Name : Genetics and Plant breeding
Course Code : **BOT -511-MJE (A)**
No. of Lectures : 60
No. of Credits : 04

A) Course objectives:

1. To study genetic inheritance and gene interactions in plants.
2. To make aware about plant breeding.
3. To evaluate conclusions based on genetic data.
4. To understand the knowledge of genetic code, gene expression and regulation.
5. To understand practical emasculation and pollination methods of important crops.
6. To understand about floral biology and selection of proper breeding method.
7. Design and analyze quantitative genetic experiments.

B) Course outcome:

CO1. Students will come to know applications of gene interactions.
CO2. Students will use breeding techniques in field.
CO3. Students get expert in evaluation of conclusions based on genetic data.
CO4. Students will get knowledge about gene expression and regulation of gene.
CO5. Students Will be able to do emasculation and pollination methods.
CO6.Students get practical knowledge about floral biology and proper breeding method.
CO. Student will get expertise in design the quantitative genetic experiments.

UNIT 1 **(15 L)**

1.1 **Principles of Mendelian inheritance and Interaction of genes:-** 6L

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

1.2 **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

1.3 **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.

UNIT 2 **(15L)**

2.1 Concept of gene, allele, multiple allele, pseudo allele, Complementation test. 4L

2.2 Hardy Weinberg's Law, Factors affecting gene and gene frequencies, Pedigree analysis in Human genetics, Genomic Imprinting. 4L

2.3 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

UNIT 3 **(15L)**

3.1 Methods of genetic transfers- transformation, conjugation and transduction in bacteria, Genetic recombination in Bacteria. 4L

3.2 Lytic and lysogenic cycles in phages, Genetic recombination, specialized transduction and mapping the bacteriophage genome. 4L

3.3 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

UNIT 4 **(15L)**

4.1 Centers of origin, distribution and areas of diversity, Importance of genetic diversity in crop improvement, Importance of genetic diversity in conservation and regulation. 3L

4.2 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

4.3 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. Ahluwalia K.B (2005): (First Edition). Genetics. New Age International Private Ltd.
2. Allard R.W (1995): Principles of Plant Breeding. John Wiley and Sons, Ice.,Singapore.
3. Chahal G. S and Gosal S. S (2002): Principles and procedures of Plant Breeding, Narosa.
4. Gardner and Simmons Snustad (2005): (Eighth Edition). Principles of Genetics, John Wiley and Sons,Singapore.
5. Hartk D.L and Jones, E.W (1998): Genetics Principles and Analysis (Fourth Edition).

Jones and Bartlett Publishers, Massachusetts, USA.

6. Lewin, B. (2000): Gene VII. Oxford University Press, New York,USA.
7. Pawar C. B. (2003): (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai. Publishers, New Delhi.
8. Sariu C. (2004): (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd., New Delhi.
9. Sharma J. R. (1994): Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers Company Ltd., New Delhi.
10. Singh B. D. (1996): Plant Breeding – Principles and methods. Kalyani Publications, Ludhiana.
11. Singh B. D. (2004). Genetics. Kalyani Publication, Ludhiana. 26. Gupta P.K Genetics and Cytogenetics, Rastogi Publications.
12. Snustad, D. P. and Simmons, M. J. (2000): Principles of Genetics (Second Edition). John Wiley and Sons Inc.,USA.
13. Strickberger (2005): (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
14. Toun N and TrempyJanire (2004): (First Indian Reprint). Fundamental Bacterial Genetics. Blackwell Publishing Co.

Choice Based Credit System Syllabus (2023 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Genetics and Plant Breeding **Course Code:** BOT -511-MJE (A)
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.

Name of the Programme **:** M.Sc.
Subject : Botany
Program Code **:** PSBOT
Class **:** M.Sc. I
Semester **:** I
Course Type **:** Elective Theory
Course Name **:** Advanced Botanical Techniques.
Course Code **: BOT -511-MJE (B)**
No. of Lectures **:** 60
No. of Credits **:** 04

A) Course objectives:

1. To understand different concepts in botanical techniques.
2. To understand microscopy, different types and working of microscopes.
3. To understand practical applications of microscopic techniques.
4. To impart the basic skills about centrifugation techniques.
5. To impart the knowledge about electrochemical techniques.
6. To impart knowledge about DNA sequencing techniques.
7. To understand different Immunological process.

B) Course outcomes:

CO1. Enrich student knowledge with advance botanical techniques.
CO2. Students get knowledge about different types and working of microscopes.
CO3. Students' expertise in microscopic techniques.
CO4. Students will expertise in different centrifugation techniques.
CO5. Students get expertise in different electrochemical techniques.
CO6. Students get knowledge about DNA sequencing techniques.
CO7. Students get knowledge about antigen –antibody interaction.

UNIT 1 **(15 L)**

1.1 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). 8L

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

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

UNIT 2 **(15L)**

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

2.2 **Electrochemical techniques:** Electrical conductivity, pH meter, Oxygen electrode 2L

2.3 **Immunological techniques:** Principles, Antigen–antibody interaction, Immuno diffusion, Immuno precipitation, Radio-immuno assay, Rocket immuno-electrophoresis. 4L

2.4 **Molecular biology techniques:** DNA sequencing techniques- Sanger's method, Maxam-Gilbert's method, Automated DNA sequencing, Pyrosequencing, Sequencing of proteins. 5L

UNIT 3 **(15L)**

3.1**Chromatography techniques:-**

Introduction, concept of partition coefficient, Column, Gel filtration, Affinity, Ion exchange and HPLC. 7L

3.2 **Eletrophoretic techniques:-**

History, Principles, Agarose Gel Electrophoresis (AGE), Pulsed Field Gel Electrophoresis and Polyacrylamide Gel Electrophoresis (PFGE). 7L

UNIT: 4 **(15L)**

4.1 **Spectroscopic techniques:** UV-Visible spectroscopy, Nuclear Magnetic Resonance (NMR) spectroscopy, X-ray crystallography, Spectroflurometry, AAS, MS and IR Spectroscopy. 5L

4.2 **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. 10L

REFERENCES:-

1. Annie and Arumugam (2000): Biochemistry and Biophysics, Saras Publishing,Tamilnadu.
2. Bisen P. S. Mathur S. (2006): Life Science in Tools and Techniques. CBS Publishers, Delhi.
3. Khasim S.M. (2002): Botanical Microtechniques: Principles and Practice. Capital Publishing Company.
4. Krishnamurthy K.V. (1999): Methods in Cell Wall Cytochemistry. CRC Press. LLC.
5. Marimuthu R. (2008): Microscopy and Microtechnique. MJP Publishers, Chennai.
6. P. Gunadegaram (1995): Laboratory Manual in Microbiology. New Age International (P) Ltd.
7. Srivastava S. and Singhal V. (1995): Laboratory Methods in Microbiology. Anmol Publication Pvt. Ltd. Delhi.
8. Srivistava M.L. (2008): Bioanylatical Techniques. Narosa Publishing House (P) Ltd.
9. Wilson K., Walker J. (2000): Practical Biochemistry Principles and Techniques. Cambridge University Press.
10. Wilson K., Walker J. (2005): Principles and Techniques in Biochemistry and Molecular Biology. Cambridge University Press.

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Advanced Botanical Techniques **Course Code**: BOT -511-MJE (B)
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.

Name of the Programme : M.Sc.
Subject : Botany
Program Code : PSBOT
Class : M.Sc.
Semester : I
Course Type : Research Methodology
Course Name : Research Methodology
Course Code : **BOT - 521- RM**
No. of Lectures : 60
No. of Credits : 04

A) Course objectives:

1. To impart the knowledge and skills of research methodology.
2. To equip the students with the tools and methods of research.
3. To give idea about analysis of research data.
4. To train them in documenting research.
5. To aware the students about the need of conservation of biodiversity.
6. To know the scope of different branches of botany.
7. To train advanced techniques in botany.

B) Course outcomes:

CO1. Students will be able to develop skills of research methodology.
CO2. Students are expertise in handling tools and methods of research.
CO3. Student will able to analyze research data.
CO4. Students get expert in compiling research documents.
CO5. Students will recognize conservation of biodiversity
CO6. Students will analyze use of different branches of botany.
CO7. Students will able to use different techniques in their botanical research.

UNIT 1 **(15L)**

1.1 **Foundations of Research**:

Meaning, Objectives, Concept of theory, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process. 6L

1.2 **Problem Identification and Formulation, Hypothesis**

Qualities of a good Hypothesis –Null Hypothesis and Alternative Hypothesis. Hypothesis Testing Logic & Importance. 4L

1.3 **Research Design**

Concept and Importance in Research – Features of a good research design Descriptive Research Design concept, types and uses. Experimental Design: Concept of Independent and Dependent variables. 5L

UNIT-2 **(15L)**

2.1 Type of Research

Qualitative research and Quantitative research: Concept of measurement, causality, generalization and replication. 4L

2.2 **Sampling**

Concepts of Statistical Population, Sample, Sampling Error, Sample Size, Characteristics of a good sample. Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. 7L

2.3 **Data Analysis**

Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. 4L

UNIT-3 (15L)

3.1 **Biosystematics:** Aims, objectives and scope of taxonomy, Nomenclature and classification. Taxonomic literature, Evolutionary trends and variations, ICN, phylogenetic classifications, APG system of classification, species concepts, speciation, Biosystematics, biosystematic categories. Taxonomy and conservation. 10L

3.2 Plant diversity: Biodiversity conservation, *In-Situ* and *Ex-Situ* conservation. Climate change and Biodiversity. Biodiversity and Forest Acts. 5L

UNIT - 4 (15L)

4.1 Role of Botanical Gardens in plant conservation. Concept of Lead Botanical Gardens and Biodiversity Parks. 3L

4.2 Phytochemicals used in aroma, flavour and medicines, plant resources and natural products. 4L

4.2 Modern trends: DNA barcoding, rDNA technology and applications, nanotechnology: use of plants for synthesis of Nano materials. 5L

4.3 Biostatistics: Introduction to databases and retrieving information from databases, Molecular tools in protein and nucleotide sequence analysis. 3L

References:

1. Ray Samit and A. K. Ray (Ed.) (2006): Biodiversity and Biotechnology. New Central Book Agency Ltd. Kolkata.
2. Gupta, P.K. (2006): Cell and Molecular Biology, Third edition. Rastogi Publications, Meerut.
3. Singh G. (2010): Plant systematic: An Integrated approach. Science Publisher. USA.

4. Groom, M. J., Meffe, G. K. and Carroll, C. R. (2006): Principles of conservation biology. Sinauer Associates, Inc.
5. C. R. Kothari (2004): Research Methodology- Methods and Techniques, New Age Publ. Wiley Eastern
6. Dawson, C. (2002): Practical Res. Methods. New Delhi. UBS Publ.
7. Kumar Ranjit (2005): Res. Methodology. A step by step Guide for Beginners. Singapore, Pearson Education.
8. Etelkaleadlay and Stephen jury (Ed.) (2006): Taxonomy and plant conservation. Cambridge University Press. UK.
9. Agarwal, S. K. (2007): Bioinformatics. APH Publishing Corporation, New Delhi.

Choice Based Credit System Syllabus (2023 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. I (Sem. I) **Subject**: Botany
Course: Research Methodology **Course Code**: BOT -521-RM
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				3					
CO 5	2								
CO 6	2								
CO 7						3			

Justification for the mapping

PO1: Disciplinary Knowledge

CO2. Understand scope and applications of biodiversity.
CO3. Apply research design for obtained data.
CO5. Recognize conservation of biodiversity
CO6. Analyze use of different branches of botany.

PO 4: Research-related skills and Scientific temper

CO1. Develop skills of research methodology.
CO4. Compile research documents.

PO6: Personal and Professional Competence

CO7. Different instrumentation techniques in botanical research.