Anekant Education Society's

TuljaramChaturchand 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

TuljaramChaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

(Eligibility : B.Sc. Botany/ Environmental Science)

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

Preamble

AES's TuljaramChaturchand College of Arts, Science and Commerce (Autonomous) has made the decision to change the syllabiof 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 TuljaramChaturchand 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 Botanysyllabi 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

ProgrammeSpecific Outcomes (PSOs)

PSO1.**Knowledge and understanding of:** 1. The range of plant diversity in terms of structure, anatomy, function and environmental relationships. 2. The evaluation of plant diversity. 3. Identification and classification and the flora of Maharashtra. 4. The role of plants in the functioning of theglobalecosystem. 5. A selection of more specialized, optional topics. 6. Application of Statistics to solve biological problems.

PSO2. **Intellectualskills–ableto:**1.Thinklogicallyandorganizetasksintoastructuredform2. Assimilate knowledge and ideas based on wide reading and through the internet. 3.Transfer of appropriate knowledge and methods from one concept to another within thesubject. 4. Understand the evolving state of knowledge in a rapidly developing research field. 5.Construct and test hypothesis. 6. Plan, conduct and write a report on an independent termproject.

PSO3.**Practicalskills:**Studentslearntocarry outpracticalwork,inthefieldandinthelaboratory, with minimal risk. They gain introductory experience in applying each of thefollowing skills and gain greater proficiency in a selection of them depending on theirchoiceofoptionalmodules.1.Interpretingplantmorphologyandanatomy.2.Planti dentification. 3. Vegetation study techniques. 4. Analysis of chemical compounds in plant materials in the context of plant physiology and biochemistry. 5. Analyze data usingappropriate statistical methods and computational softwares. 6. Plant pathology to be added forlab to land form.

PSO4. **Transferable skills:** 1. Use of IT (word-processing, use of internet, statistical packagesand databases). 2. Communication of scientific ideas in writing and orally. 3. Ability toco-ordinate as part of team. 4. Ability to use library resources. 5. Time management. 6. Careerplanning.

PSO5.**Scientific Knowledge:** Apply the knowledge of basic plant science, life sciences andfundamentalprocessofplantsto studyand analyze anyplant form.

PSO6.**Problemanalysis**:Identifythetaxonomicpositionofplants,formulatetheresear chliteratureandanalyze RET structure and non-

reportedplantswithsubstantiatedconclusions using first principles and methods of nomenclature and classificationinBotany.

PSO7. **Design/developmentofsolutions**:Designsolutionsfrommedicinalplantsto solve healthproblems,disordersanddiseaseofhumanbeingsand animalsestimatethephytochemical content of plants which fulfill the specified needs to appropriateconsiderationforthepublic and animal health.

PSO8.**Conductinvestigationsofcomplexproblems**:Useresearch-basedknowledgeandresearchmethodsincludingdesignofexperiments,analysisandinterpretationofdata,anddevelopmentoftheinformationtoprovidescientificconclusions.

PSO9. **Modern tool usage**: Create, select, and apply appropriate techniques, resources,and moderninstruments and equipment for Biochemical estimation, MolecularBiology,Biotechnology, Bioinformatics, Biophysics, Biostatistics, PlantTissuecultureexperiments,cellularandphysiological activities of plants with an understanding of the application andlimitations.

PSO10.**TheBotanistandsociety**:Applyreasoninginformedbythecontextualknowledge to assess plant diversity, its importance for society, health, safety, legalandenvironmentalissuesandtheconsequentresponsibilitiesrelevanttothebiodiversityconservationpractice.

PSO11.**Environment and sustainability**:Understand the impact of the plant diversity insocietalandenvironmentalcontexts,anddemonstratetheknowledgeof,and needfor sustainable agricultural and environmental development.

PSO12.**Ethics**:Applyethicalprinciplesandcommittoenvironmentalethicsandresponsibilitiesandnormsof thebiodiversityconservation.

PSO13.**Individualandteamwork**:Functioneffectivelyasanindividual,andasamemberorleader indiverse teams,andinmultidisciplinary task settings.

PSO14.**Communication**: Communicate effectively on complex engineering activities withthe engineering community and withsociety at large, such

as, being able tocomprehendandinterpreteffectivereportsanddesigndocumentation,makeeffectivepresentations,andgiveand receive clearinstructions.

PSO15.**Project management and finance**: Apply knowledge and understanding oftheengineeringand managementprinciplesand applythesetoone's own work,as a member and leader in a team, to manage projects and in multidisciplinary ecofriendly environments.

PSO16.**Life-long learning:** Identify the necessity, and have the preparation and abilitytoengageinindependentandlife-longlearninginthebroadestcontextofupcoming advanced technological.

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.LigadeKomal Sambhaji	Meritorious Student
16.	Mr.Zodage Ram Sanjay	Meritorious Student
17.	Ms.GargadeRutujaHanumant	Meritorious Student

Structure and Credit Distribution of PG Degree Programme
Illustrative Credit Distribution structure for Two Years/One Year P.G. (M.Sc.- Botany)

Year (2 Year PG)	Level	Sem. (2 Yr.)	Major		Research Methodology (RM)	OJT /FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
I	6.0	Sem-I	BOT -501-MJM: Plant Systematics-I**(Credit 04)** BOT -502-MJM: Cell Biology and cell Signalling **(Credit 04)** BOT -503-MJMBotany Laboratory-I**(Credit 02)** BOT -504 -MJM Botany Laboratory-II **(Credit 02)**	BOT -511-MJE(A):Genetics and Plant breeding **(Credit 04)** **OR** BOT -511-MJE(B): Advanced Botanical Techniques. **(Credit 04)**	BOT-521-RM: Research Methodology **(Credit 04)**	--	--	20	PG Diploma (after 3 Year Degree)
		Sem- II	BOT -551-MJM: Plant Systematics II **(Credit 04)** BOT -552-MJM: Plant physiology and Biochemistry**(Credit 04)** BOT -553-MJM: Botany Laboratory-I**(Credit 02)** BOT -554-MJM Botany Laboratory-II**(Credit 02)**	BOT -561-MJE (A): Molecular Biology and Genetic Engineering **(Credit 04)** BOT -561-MJE(B): Plant Ecology and Biodiversity **(Credit 04)**	--	BOT 581-OJT/ FP **(Credit 04)**	--	20	
Cum. Cr. For PG Diploma			**24**	**8**	**4**	**4**	**--**	**40**	

Abbreviations: (1) OJT: On Job Training: Internship/Apprenticeship; (2) FP: Field Projects; (3) RM: Research Methodology (4) RP: Research Projects (5) Cum.: Cumulative Credits

Course Code:BOT-501-MJM: BOT: Botany, 50: First Year P. G., 1: First Semester, First Paper, MJM: Major Mandatory Theory, MJE: Major Elective Theory

*** 1 Credit = 15 hr.**

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Credit DistributionStructure for M. Sc. Part: 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 and Cell signaling	Theory	4
	Major (Mandatory)	BOT -503-MJM	Botany Laboratory-I	Practical	2
	Major (Mandatory)	BOT -504-MJM	Botany laboratory –II	Practical	2
	Major (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
	Major (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**

CBCS SYLLABUS 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 : Major Mandatory Theory
Course Code : **BOT -501-MJM**
Course Title : Plant Systematics I
No. of Credits : 04
No. of Teaching Hours :60

A) Course objectives:

1. To create awareness and need of inculcating knowledge of Cryptogamicdiversity.
2. To give an idea about classification of cryptogams up to species level.
3. To give an idea of applied importance ofCryptogams.
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:

By the end of course students will be able to

CO1. Getknowledge about cryptogams to conserve Cryptogamic diversity.
CO2. Classify the cryptogams up to species level.
CO3. Get aware about the importance ofCryptogams.
CO4. Get knowledge about lifehistory 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.

UNIT: 1 **(22L)**

1.1Systematics and Taxonomy: Principles, outline of classification of algae up to family level according to Fritschsystem and recent developments in algal classification with special emphasis on emerging trends in molecular phylogeny and their relationships. 5L

1.2Algological studies: Algal habitats, Pigment constitution in algae, Reservefood, Modes of perennation in algae, Origin and evolution of sex, Contribution of algal studies in Indiaandworld. (Any three scientist) 4L

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

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

diagrammatic life cycle inunicellular, filamentous,multi-cellular greenalgae.4L**1.4**Brief Introduction, Comparative structure and reproduction in Charophyta, Euglenophyta, Xanthophyta, Bacillariophytaand 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'spollutionindices).1L

UNIT: 2 (23L)

2.1Fungi: 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 andworld. (Any three scientist) 5L

2.2 Myxomycotina: Distinguishing characters, types of plasmodium, fruiting bodies and lifecyclepattern 3L

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

2.4 Zygomycotina: Distinguishing characters, Thallus structure, Heterothallism and sexualreproduction. 3L

2.5 Ascomycotina: Thallus structure, Fructifications, Comparative study of HemiascomycetesandEuascomycetes 3L

2.6 Basidiomycotina: Distinguishing characters, thallus structure, typesand structure of basidiaand basidiocarps2L

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

2.8 Applicationsoffungi: Biofertilizers, biocotrol, biopesticides, food, medicine2L

UNIT: 3 (15L)

3.1Bryophytes : 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 offollowingorders:Takakiales, Calobryales and Sphaerocarpales Marchantiales, Jungermanniales,Anthocerotales,Sphagnales,Polytrichales, Funariales, Eubryales. **10L**

3.3Applications 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, ChronicaBotanica, New Delhi.
9. Krishnamurthy V. (2000): Algae of India and neighboring countries I. Chlorophycota, Oxford & IBH, NewDelhi.
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. PremPuri (1981): Bryophytes: Morphology, Growth and Differentiation. Atma Ram and Sons, NewDelhi.
14. Smith G. M. (1950): The fresh water algae of the United States, Mc-graw Hill New York.
15. Udar R. (1970): Introduction to Bryophytes. ShashidharMalaviyaPrakashan. Lucknow.
16. Udar R. (1975) : Bryology in India. ChronicaBotanica, NewDelhi.
17. Vashista B. R., Sinha A. K., Kumar A. (2008): Botany for degree students– Bryophyta, S. Chand Publication.
18. Vashista B.R, Sinha A.K and Singh V.P. (2005): Botany for degree students Algae, S. Chand Publication.
19. Watson E. V. (1971): Structure and Life of Bryophytes. 3rd Edn. Hutchinson University Library,London.
20. Webster J. and Roland W. (2007): Introduction to fungi (3rd Edn)Cambridge UniversityPress,978-0-521-80739-5.

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

A) Course objectives:

1. To introduce various aspect of Cell biology to the students.
2. To study structure of cell organelles and theirfunctions.
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:

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. Expertwith 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.

UNIT:1(15L)

1.1 **Introduction to cell biology**, Cell theory andcell 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 andsolutes. 5L

1.3 **Molecular organization and biogenesis** of chloroplast and mitochondrialmembrane.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 secretaryproteins. 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 acrossnuclearmembrane 2L

Ribosomes: Structure, Assembly and dissociation ofsubunits,function 2L

Lysosomes: Ultra structure of lysosomes, Membrane integrityand role. 2L

Glyoxysomes: Structureandfunctions. 1L

Peroxisomes: Structureandfunctions.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 ConfocalMicroscopy. 3L

UNIT:3(15L)

3.1**Signaltransduction:**Typesofreceptors: Ion channel linked receptor, Enzyme linked receptor, G Protein linked receptor.3L

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

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

3.4**Nuclear- organelle signaling** duringplastiddevelopment. 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 (Maturationpromotingfactor). 6L

4.2**Methodtostudycellcycle**-labeledmitoticcurve,flowcytometry.3L

4.3**Cell ageing and 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 controlof 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.

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

A) Course objectives:

1. To study Cryptogamic habit and habitatdiversity.
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:

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

Morphological observations, description and illustrations of following forms

1. **Cyanophyta**: Any one formfrom 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**: Anyone formfrom 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** : Anyone 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

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

A) Course objectives:

1. To study structure of cell organelles and theirfunctions.
2. To know basic biology and theoretical concepts.
3. To pertain knowledge of different cytologicaltechniques.
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:

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 techniquesin cell organelle.
CO7.Interprets cell structure and their function.

Practicals

1. Differential centrifugation for isolation of cell fractions. 1P
2. Differential centrifugation for isolation of Nuclearfraction 1P
3. Isolation of Chloroplaststostudy Hill reaction to measureintactness 1P
4. Isolation ofmitochondriafor: Estimation of succinicdehydrogenaseactivity 1P
5. Isolation of Lysosomal fraction. 1P
6. Estimation of acidphosphataseactivity 1P
7. Study of Electron Micrographs ofcellorganelles 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,glandularcells 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 chlorophylls in normal and senescent leaves.1P
14. Effect of abiotic factors on stomatal response in plants. 1P
15. Interpretation of cell cycle. 1P

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

A) Course objectives:

1. To study genetic inheritance and gene interactions inplants.
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:

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 ofconclusionsbased ongeneticdata.
CO4. Get knowledge about gene expression and regulation of gene.
CO5. Demonstrate emasculation and pollinationmethods.
CO6. Explainfloral biology for breeding techniques.
CO7. Demonstrate mutation in plant cells.

UNIT: 1 **(15 L)**

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

Dominance, Segregation, Independent assortment, Interactionof genes-Complementary, epitasis, inhibitory, polymeric andadditive.Extensions of Mendelian principles: Phenocopy andPleiotropy.

1.2**Cytoplasmicinheritance:** 3L

Mitochondrial chloroplastgenomes, 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, Polygenictraits:corolla length in *Nicotiana*, Cob length in *Zea mays*, Heritability and itsmeasurement Chromosomal theory of inheritance: Inheritance of X and Y linkedgenes, Sex limited and sex influencedgenes.

UNIT: 2 **(15L)**

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

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

2.3Linkage and Recombination in Chromosomes: homologous, non-homologous, site specific recombination, Linkage maps, LOD score for linkagetesting, Tetrad analysis inYeast (unordered), *Neurospora* (ordered). 7L

UNIT: 3 **(15L)**

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

3.2Lytic and lysogenic cycles inphages, Genetic recombination, specialized transductionand mapping the bacteriophagegenome. 4L

3.3Structure, Organization of chromosome, Concept ofkaryotope, Preparation of chromosome for Karyotype, Chromosomal alterations **:**Deletion, duplication, inversion, translocation, complextranslocations, Robert sonian and BA translocations. 7L

UNIT: 4 **(15L)**

4.1Centers of origin, distribution and areas of diversity, Importance of genetic diversity in cropimprovement, Importance of genetic diversity in conservation andregulation.3L

4.2Cross and selfpollination, Pollination control mechanisms andimplications, 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/distantCrosses. 9L

4.3Physical and chemical mutagens, General method of induction of mutations in cropplant, Role of inducedmutations, Induction of polyploidy in cropplants,Role of polyploidy in plantbreeding. 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.

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

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 centrifugationtechniques.
5. To impart the knowledge about electrochemicaltechniques.
6. To impart knowledge about DNA sequencing techniques.
7. To understand different Immunological process.

B) Course outcomes:

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 centrifugationtechniques.
CO5.Train to use different electrochemicaltechniques.
CO6.Understand DNA sequencing techniques.
CO7. Analyze antigen –antibody interaction.

UNIT:1 **(15 L)**

1.1 Image formation (properties of light), Lens- refraction, magnification concept, resolutionconcept. Light microscopy, Confocal microscopy, Phase Contrast microscopy, Fluorescence microscopy, Electron microscopy (SEM and TEM). 8L1.2 Microtomy- serial sectioning, double or multiple staining, Lesser assisted Microtomy

4L

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

UNIT:2 (15L)

2.1**Centrifugationtechniques:** Principles, Types (Analytical and Preparative), Rotors and their types, Ultra centrifugation, Density Gradient Centrifugation, Highspeedcentrifuges.4L

2.2**Electrochemicaltechniques:**Electrical conductivity, pH meter,Oxygenelectrode 2L

2.3**Immunologicaltechniques:** Principles, Antigen–antibody interaction, Immuno diffusion, Immuno precipitation, Radio-immuno assay, Rocket immuno-

electrophoresis. 4L

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

UNIT :3(15L)

3.1**Chromatographytechniques:-**

Introduction, concept of partition coefficient, Column, Gel filtration, Affinity, Ion exchange and HPLC (High Pressure Liquid Chromatography). 7L

3.2**Eletrophoretictechniques:-**

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

UNIT: 4 (15L)

4.1**Spectroscopictechniques:**UV-Visible spectroscopy, NMR spectroscopy,X-ray crystallography, Spectroflurometry, AAS, MS and IR Spectroscopy. 5L

4.2 **Radioactivetechniques:**

Radioisotopes used in biology and their properties, Units of radioactivity, Interaction of radioactivity with matter, Detection and measurement of radioactivity, Autoradiography, Safe handling of radioisotopes, Non-Radiolabeled techniques, Green Fluorescent Proteins, Incorporation of radioisotopes in biological tissues and cells, Molecular imaging ofradioactivematerial. 10L

REFERENCES:-

1. Annie and Arumugam (2000): Biochemistry and Biophysics, SarasPublishing,Tamil Nadu.
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.

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

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:

By the end of course students will be able to

CO1. Develop skills of research methodology.
CO2. Understand scope and applications of biodiversity.
CO3. Apply research design for obtained data.
CO4. Compile research documents.
CO5. Recognize conservation of biodiversity
CO6. Analyze use of different branches of botany.
CO7. Different instrumentation techniques in 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, biosystematiccategories. 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

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

4.2Modern trends: DNA barcoding, rDNA technology and applications, nanotechnology: use of plants for synthesis of Nanomaterials. 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.

Examination Pattern / Evaluation Pattern

Teaching and Evaluation (for Major, Minor, AEC, VEC, IKS courses)

Course Credits	No. of Hours per Semester Theory/Practical	No. of Hours per Week Theory/Practical	Maximum Marks	CE 40 %	ESE 60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	4 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Teaching and Evaluation (for VSC, SEC & CC courses)

- Evaluation to be done by Internal & External Experts
- No descriptive end semester written examination
- Evaluation to be done at Department level preferably prior to commencement of Theory /Practical Examinations
- Evaluation to be done on the Skills gained by student