

Academic Council

Item No: _____

Devrukh Shikshan Prasarak Mandal's

**Nya. TATYASAHEB ATHALYE ARTS, Ved. S.R. SAPRE
COMMERCE & Vid. DADASAHEB PITRE SCIENCE
COLLEGE, DEVRUKH [AUTONOMOUS]**



Syllabus for S.Y. B.Sc.

Program: B.Sc.

Course: Botany

**Credit Based Semester and Grading System with the
Effect from
Academic Year 2020-21**

B. Sc. General (Semester Pattern) B. Sc. Second Year

BOTANY – CURRICULUM

Semester	Paper	Lectures /Practicals	Marks			Credits
			External	Internal	Total	
Semester III	Theory Paper I - Plant Diversity 2	45	70	30	100	02
	Theory Paper II – Form and Function 2	45	70	30	100	02
	Theory Paper III – Current Trends in Plant Sciences 1	45	70	30	100	02
	Practical Paper I – Plant Diversity 2	10	35	15	50	01
	Practical Paper II – Form and Function 2	10	35	15	50	01
	Practical Paper III – Current Trends in Plant Sciences 1	10	35	15	50	01
Semester IV	Theory Paper I - Plant Diversity 2	45	70	30	100	02
	Theory Paper II – Form and Function 2	45	70	30	100	02
	Theory Paper III – Current Trends in Plant Sciences 1	45	70	30	100	02
	Practical Paper I – Plant Diversity 2	09	35	15	50	01
	Practical Paper II – Form and Function 2	12	35	15	50	01
	Practical Paper III – Current Trends in Plant Sciences 1	12	35	15	50	01

Semester III Theory Paper I

Learning Objectives:

The students will be able to understand-

- The morphology, structure and importance of the organisms.
- State the meaning of scientific terms.
- Differentiate between various groups of Algae, Bryophyte, and Angiosperms.
- Concept of Biodiversity and various techniques

Course Code USBOT31	Title	Lectures	Credits
Unit	Plant Diversity 2	45	02
Unit I Thallophyta (Algae) & Bryophyta	1. General Characters of Division Phaeophyta 2. Structure, life cycle and systematic position of <i>Sargassum</i> 3. General Account of Class Anthocerotae and Musci 4. Structure, life cycle and systematic position of o <i>Anthoceros</i> o <i>Funaria</i>	15	
Unit II Angiosperms	1. Systematics: Objectives and Goals of Plant systematic 2. Plant Nomenclature 3. Bentham and Hooker's system of Classification 4. With the help of Bentham and Hooker's system of Classification for flowering plants study the vegetative, floral characters and economic importance of the following families: o Leguminosae (Fabaceae, Caesalpinaceae, Mimosae) o Asteraceae o Amaranthaceae o Palmae o Combretaceae	15	
Unit III Biodiversity and Modern Techniques to Study Plant Diversity	1. Biodiversity: Definition, Concept, Scope, Importance, Threats. Biodiversity Hotspots in India. Plant biodiversity in Konkan region, Strategies for Biodiversity Conservation, Sacred groves 2. Preservation methods :Dry and Wet method 3. Microscopy – Principle and working of Light and electron microscope- Scanning Electron Microscopes (SEM) 4. Chromatography- Principles and techniques in paper and thin layer chromatography 5. Principles and techniques of Horizontal and Vertical electrophoresis.	15	

Semester III Theory Paper II

Learning Objectives:

The students will be able to understand-

- Structure and function of cell and cell organelles.
- Variation in chromosome number, structure and its effect on Organism.
- DNA's autocatalytic and heterocatalytic functions.

Course Code USBOT32	Title	Lectures	Credits
Unit	Form and Function 2	45	02
Unit I Cell Biology	1.Ultra Structure and functions of the following cell organelles: Mitochondrion, Peroxisomes, Glyoxisomes, Ribosomes 2.Cell Division and its significance: Cell Cycle, Structure of Interphase Nucleus, Mitosis & Meiosis, Differences between Mitosis and Meiosis 3. Nucleic Acids: Types, structure and functions of DNA and RNA	15	
Unit II Cytogenetics	1. Variation in Chromosome structure (Chromosomal Aberrations) Definition, Origin, Cytological and Genetic Effects of the following: Deletions, Duplications, Inversions and Translocations. 2. Sex determination, Sex linked, sex influenced and sex limited traits : Sex determination: Chromosomal Methods: heterogametic males and heterogametic females. Sex determination in monoecious and dioecious plants. Genic Balance Theory of sex determination in <i>Drosophila</i> , Lyon's Hypothesis of X chromosome inactivation. Sex linked: eye colour in <i>Drosophila</i> , Haemophilia, colour blindness Sex influenced: baldness in man 3. Extranuclear Genetics Organelle heredity- Chloroplast determines heredity - Plastid transmission in plants, Streptomycin resistance in <i>Chlamydomonas</i> . Male sterility in maize	15	
Unit III Molecular Biology	1. DNA replication: Modes of Replication, Meselson and Stahl Experiment, DNA replication in prokaryotes and eukaryotes- enzymes involved and molecular mechanism of replication. 2. Protein Synthesis: Central dogma of Protein synthesis Transcription in prokaryotes and eukaryotes: promoter sites, initiation, elongation and termination. RNA processing: Adenylation & Capping.	15	

Semester III Theory Paper III

Learning Objectives:

The students will be able to understand-

- Current trends in plant sciences.
- Pharmacognosy and primary-secondary metabolites
- Concept of Organic Farming, Economic Botany and types of forests
- Various industries based on plant products

Course Code USBOT33	Title	Lectures	Credits
Unit	Current Trends in Plant Sciences	45	02
Unit I Pharmacognosy and phytochemistry	1. Introduction to pharmacopoeia, Indian pharmacopoeia. It's significance 2. Primary and Secondary Metabolites 3. Secondary Metabolites: Alkaloids, Glycosides, Tannins, Volatile oils, Gums, Resins : Sources, Properties, Uses 4. Adulterants and with example of <i>Saraca asoca</i> and <i>Polyalthia longifolia</i> , <i>Terminalia arjuna</i> and <i>Terminalia tomentosa</i>	15	
Unit II Forestry, Organic Farming and Economic Botany	1. Forestry: Definition, Outline of types of forest in India 2. Organic Farming: Definition, History, Concept, Need, Aims and Objectives, Components, Advantages and Disadvantages, Organic Farming in World and India 3. Economic Botany: Definition, Concept 4. Spices and condiments: Cardamom and Black pepper	15	
Unit III Industry based on plant products	1. Aromatherapy- Introduction, Uses with few examples. Jojoba, Lemon, Jasmin 2. Botanical and nutraceuticals - <i>Spirulina</i> , <i>Vanillin</i> , <i>Garcinia indica</i> / <i>Garcinia cambogia</i> , <i>Chlorella</i> . 3. Biofuels: Algae and plants suitable for biofuels 4. Fruit processing: Methods and Opportunities	15	

Course Code USBOP31 Semester III Practical Paper I – Plant Diversity 2

Sr.No.	Practicals	L	Cr
		30	01
1	Study of stages in the life cycle of <i>Sargassum</i> from fresh/ preserved material and permanent slides.		
2	Study of range of thallus in Phaeophyta		
3	Study of stages in the life cycle of <i>Anthoceros</i> from fresh/ preserved material and permanent slides.		
4	Study of stages in the life cycle of <i>Funaria</i> from fresh/ preserved material and permanent slides.		
5	Study following families prescribed: morphological peculiarities and economic importance of the members Fabaceae, Caesalpinaceae, Mimosae Asterace Amaranthaceae Palmae Combretaceae		
6	Preparation of herbarium and wet preservation technique		
7	Chromatography: Separation of amino by circular paper chromatography		
8	Separation of Carotenoids by thin layer chromatography		
9	Study of biodiversity in region (visit to local area for flora study)		
10	Horizontal and Vertical Gel Electrophoresis – Demonstration		

Course Code USBOP32 Semester III Practical Paper II– Form and Function 2

Sr.No.	Practicals	L	Cr
		30	01
1	Study of the ultra-structure of cell organelles prescribed for theory from Photomicrographs.		
2	Study of mitosis from suitable plant material.		
3	Study of meiosis from suitable plant material.		
4	Estimation of DNA from plant material (one Std & one Unknown, No Std Graph)		
5	Estimation of RNA from plant material (one Std & one Unknown, No Std Graph)		
6	Study of inheritance pattern with reference to Plastid Inheritance		
7	Study of cytological consequences of chromosomal aberrations (Laggards, Chromosomal Bridge, Ring chromosome, Chromosomal ring) from permanent slides or photomicrographs		
8	DNA sequencing by Sanger's method		
9	Determining the sequence of amino acids in the protein molecule synthesised from the given m-RNA strand of prokaryotes.		
10	Determining the sequence of amino acids in the protein molecule synthesised from the given m-RNA strand of eukaryotes		

Course Code USBOP33 Semester III
Practical Paper III – Current Trends in Plant Sciences

Sr.No.	Practicals	L	Cr
		30	01
1	Study of types of forests in India		
2	Tests for alkaloids		
3	Tests for glycosides		
4	Tests for tannins		
5	Study of Saraca asoka, Terminalia arjuna		
6	Study of process of composting and vermicomposting		
7	Spices and Condiments: Cardamom and Black pepper		
8	Evaluation of Nutraceutical value of mushroom/ wheat germ		
9	Preparation of jams from fruits		
10	Preparation of jellies from fruits		

Semester IV Theory Paper I

Learning Objectives:

The students will be able to understand-

- The morphology, structure and importance of the organisms.
- Differentiate between various groups of Fungi, Pteridophyte, Lichens and Gymnosperms.
- Concept of plant pathology and plant diseases.
- Concept of paleobotany and geological time scale.

Course Code USBOT41	Title	Lectures	Credits
Unit	Plant Diversity 2	45	02
Unit I Fungi, Plant Pathology and Lichens	1. Fungi General characters of Ascomycetae and Basidiomycetae 2. Structure, life cycle and systematic position of <i>Agaricus</i> and <i>Xylaria</i> 3. Plant Pathology- Symptoms, causative organism, disease cycle and control measures of Powdery mildew and Late blight of potato 4. Lichens- Classification, Structure, Method of Reproduction, Economic Importance and Ecological Significance of Lichens.	15	
Unit II Pteridophyta and Paleobotany	1. Pteridophyta- Salient features, Structure, life cycle and systematic position of <i>Selaginella</i> 2. Paleobotany- The geological time scale; Formation and types of fossils 3. Structure and systematic position of form genus <i>Rhynia</i>	15	
Unit III Gymnosperms	1. Salient features, and economic importance of Coniferophyta 2. Structure, life cycle and systematic position of <i>Pinus</i> 3. Structure and systematic position of the form genus <i>Cordaites</i>	15	

Semester IV Theory Paper II

Learning Objectives:

The students will be able to understand-

- Anatomical structure and functions of various tissues and tissue system.
- The mechanism of Respiration and its significance
- Biogeochemical cycles and its importance to the soil and plants

Course Code USBOT42	Title	Lectures	Credits
Unit	Form and Function 2	45	02
Unit I Anatomy	1. Normal Secondary Growth in Dicotyledonous stem and root. 2. Growth rings, periderm, lenticels, tyloses, heart wood and sap wood. 3. Mechanical Tissue system: Tissues providing mechanical strength and support and their disposition, I-girders in aerial and underground organs 4. Types of Vascular Bundles	15	
Unit II Plant Physiology and Plant Biochemistry	1. Respiration: Aerobic: Glycolysis, TCA Cycle, ETS & Energetic of respiration; Anaerobic respiration. 2. Photorespiration: Introduction to photorespiration, Mechanism of photorespiration 3. Photoperiodism: Phytochrome response and Vernalization with reference to flowering in higher plants, Physico-chemical properties of phytochrome, Pr-Pfr interconversion, Role of phytochrome in flowering of SDPs and LDPs. 4. Vernalization: mechanisms and applications.	15	
Unit III Ecology and Environmental Botany	1. Biogeochemical Cycles: Carbon, Nitrogen and Water. 2. Ecological factors: Concept of environmental factors, Soil as an edaphic factor, Soil composition, Types of soil, soil formation, soil profile. 3. Community ecology: Characters of community Quantitative characters and qualitative characters	15	

Semester IV Theory Paper III

Learning Objectives:

The students will be able to understand-

- Current trends in plant sciences.
- Various terms and concepts of horticulture and gardening.
- Various techniques in biotechnology
- Concept of Biostatistics and Bioinformatics.

Course Code USBOT43	Title	Lectures	Credits
Unit	Current Trends in Plant Sciences	45	02
Unit I Horticulture and Gardening	1. Introduction to Horticulture: Branches of Horticulture Gardening: 2. Locations in the garden- edges, hedges, lawn, flower beds, avenue, water garden (with plants suitable for each category). Focal point. 3. Types of garden as Formal and informal gardens 4. Botanical Garden and its Importance 5. Landscape Designing and Bonsai preparation	15	
Unit II Biotechnology	1. Introduction to plant tissue culture and applications of tissue culture 2. Laboratory organization and techniques in plant tissue culture o Totipotency o Organogenesis o Organ culture – root cultures, meristem cultures, anther and pollen culture, embryo culture. 3. R-DNA technology Gene cloning 4. Enzymes involved in Gene cloning 5. Transgenic plants	15	
Unit III Biostatistics and Bioinformatics	1. Biostatistics: The chi square test. Correlation – Calculation of coefficient of correlation. 2. Bioinformatics Information technology: History and tools of IT, Internet and its uses. 3. Introduction to Bioinformatics- goal, need, scope and limitation 4. Tools of Bioinformatics- tools for web search, Data retrieval tools- Entrez, BLAST	15	

Course Code USBOP41 Semester IV Practical Paper I – Plant Diversity 2			
Sr.No.	Practicals	L	Cr
		30	01
1	Study of stages in the life cycle of <i>Agaricus</i> from fresh/ preserved material and permanent slides.		
2	Study of stages in the life cycle of <i>Xylaria</i> from fresh/ preserved material and permanent slides.		
3	Study of Powdery mildew disease		
4	Study of Late blight of potato disease		
5	Study of Lichens (crustose, foliose, & fruticose)		
6	Study of stages in the life cycle of <i>Selaginella</i> from fresh/ preserved material and permanent slides		
7	Study of form genera <i>Rhynia</i> with the help of permanent slides/ photomicrographs		
8	Study of stages in the life cycle of <i>Pinus</i> from fresh/ preserved material and permanent slides		
9	Study of the form genus <i>Cordaites</i> with the help of permanent slide/ photomicrographs.		

Course Code USBOP42 Semester IV Practical Paper II – Form and Function 2			
Sr.No.	Practicals	L	Cr
		30	01
1	Study of normal secondary growth in the stem and root of a Dicotyledonous plant		
2	Types of mechanical tissues, mechanical tissue system in aerial, underground organs.		
3	Study of conducting tissues- Xylem and phloem elements in Gymnosperms and Angiosperms as seen in LS and through maceration technique.		
4	Study of different types of vascular bundles.		
5	Growth rings, periderm, lenticels, tyloses, heart wood and sap wood		
6	Q ₁₀ – germinating seeds using Phenol red indicator		
7	NR activity – <i>in-vivo</i>		
8	Estimation of proteins by Lowry's method (Prepare standard graph).		
9	Study of the working of the following Ecological Instruments- Soil thermometer, Soil testing kit, Soil pH, and Wind anemometer.		
10	Mechanical analysis of soil by the sieve method & pH of soil.		
11	Quantitative estimation of organic matter of the soil by Walkley and Blacks Rapid titration method.		
12	Study of vegetation by the list quadrant method		

Course Code USBOP43 Semester IV			
Practical Paper III – Current Trends in Plant Sciences			
Sr.No.	Practicals	L	Cr
		30	01
1	Study of five examples of plants for each of the garden locations as prescribed for theory		
2	Preparation of garden plans – formal and informal gardens		
3	Landscape designing		
4	Preparation of bonsai		
5	Various sterilization techniques		
6	Preparation of Stock solutions, Preparation of MS medium		
7	Seed sterilization, callus induction		
8	Regeneration of plantlet from callus.		
9	Chi square test		
10	Calculation of coefficient of correlation		
11	Web Search – Google, Entrez		
12	BLAST		

Reference Books

1. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises
2. Cryptogamic Botany Volume I and II by G M Smith, McGraw Hill.
3. Text book of Fungi by O.P. Sharma, Tata McGraw
4. Morphology and Evolution of Vascular Plants by Gifford, E. M. and Foster, A. S., W.H. Freeman & Co., New York.
5. Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi.
6. Ecology by Odum P Eugene
7. Comparative Morphology of Vascular Plants Foster, A. S. and Gifford, A.E.M. jr. Vakils, Peffer & Simons Pvt., Ltd.
8. A text book of Plant Ecology Ambasht R.S.
9. Taxonomy of Vascular Plants. Lawrance. G.H.M. 1951. MacMillan, NewYork.
10. Environmental Science: A Global Concern by Cunningham.W.P. and Saifo S.W. 1997. WCB. McGraw Hill.

11. Biochemistry and Molecular Biology of Plants. By Buchanan. B.B. Grussem. W. and Jones. R.L. 2000. American Society of Plant Physiologists, Maryland, USA.
12. Plant Metabolism (2nd Edition) by Collins. H.A. and Edwards D.H. Lefebvre. D.D. and Layzell. D.B. (eds) 1997. Longman, Essex, England
13. Genetics by Russel. Wesley Longman inc publishers. (5th edition)
14. Plant Physiology by Taiz and Zeiger Sinauer Associates inc. publishers
15. Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore.
16. Pharmacognosy by Trease G.E. and Evans. W.C. , Tyler V.E Brady
17. Biotechnology by Mohan P. Arora
18. Fundamentals of Ecology by Dash, Madhab & Dash Satya P.
19. Plant Tissue culture by S.P. Mishra
20. Fundamentals of Cytology by L. W. Sharp.
21. Biotechnology An Expanding Horizons by B.D.Singh
22. Biotechnology by Verma S.K.
23. Economic Botany by Pandey B. P (1987)
24. Text book of Economic Botany Verma V. (1984)
25. Fundamentals of genetics by B. D. Singh
26. Plant Biochemistry by Helat, Hans Walter.
27. Environmental Biology by Verma P S
28. Understanding Plant Biochemistry by Mishra, S.R.
29. A textbook of Botany by S N Pandey and P S Trivedi
30. Environmental Science by Santra S C
31. A Text Book Of Botany – Angiosperms by Pandey, B. P.
32. Diversity And Globalization by Rowntree Les And Others
33. Text book of pharmacognosy by Wallis,T.E.
34. Nursery and Landscaping by Veena Amarnath
35. Indoor Gardening by S.C.Day

36. Gardening by Parimal Mehra
37. A textbook of Fungi Bacteria and Viruses
38. Molecular Biology by David Freifelder
39. A textbook of Botany Angiosperms by B. P. Pandey
40. College Botany I, II, III, IV by S. Sundara Rajan
41. Botany by V. Verma
42. Plant Physiology by S. Sundara Rajan
43. Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker
44. Biostatistics: Principles and Practice by B. Antonisamy, Solomon Christopher, P. Prasanna Samuel
45. A textbook of Practical Botany 2 by Ashok Bendre and Ashok Kumar
46. Environmental Issues And Challenges by Dutta A./ Dutta S.
47. A Textbook of Biotechnology by Dubey, R. C.
48. Botany For Degree Students – Pteridophyta by Vashishta, P. C. ; Sinha, A. K. & Kumar, Anil
49. Botany For Degree Students – Fungi by Vashishta, P. C. & Sinha, A. K.
50. Botany for Degree Students - Bryophyta by Vashishta, B. R. ; Sinha, A. K. & Kumar, Aadarsh.
51. Introduction To Biostatics (A Textbook of Biometry) by Banerjee, Pranab. Kumar
52. Botany For Degree Students by Dutta, A.C.
53. Introduction Plant Physiology by Noggle, G. Ray & Fritz, George J. .
54. Principles of Genetics by Gardner, E.J.: sIMMONS, m.j. & Snustad, D.P.
55. Molecular Biology by Freifelder, David.
56. Fundamentals of Molecular Biology by Rastogy, Veer Bala.
57. Molecular Biology by Arora, Mohan P. & Kanta, Chander.
58. Advances in Biotechnology by Jogdand, S. N.
59. Molecular Biology by Kumar, H.D.

60. Genetics by Gupta, P.K.
61. Biostatistics by Balaji, K. : Raghavaiah, A.V.S. & Jayaveera, K.N.
62. Plant Anatomy & Embryology by Pandey, S.N. & Chadha, A.
63. Text Book of Economic Botany by Mishra, S.R.
64. Medicinal Plants by Joshi, S.G.
65. Plant Tissue Culture : Basic & Applied by Jha, Timir Baran & Ghosh, Biswajit.
66. An Introduction to Mycology by Mehrotra, R.S. & Aneja, K.R.
67. Economic Botany by Dutt, Ashwini.
68. Textbook of Economic Botany by Varma, V.
69. Fundamentals of Biostatistics by Rastogi, Veer Bala.
70. Biostatistics : Principles & Practice by Antonisamy , B , & Others .
71. Taxonomy Of Vascular Plants by Lowrence , George , H , M.
72. Plant Taxonomy by Sharma , O , P.
73. Textbook Of Botany And Pharmacognosy by Kraemer , Henry.
74. Assessment & Control of Biochemical Methods by Hector, Terry. H.
75. Molecular Cell Biology by C.B. Pawar
76. Biotechnology In Plant Science by N. C. Kumar.
77. Introduction To Plant Tissue Culture by M , K , Razdan.
78. College Botany Practical Vol – I,II by S , C , Santra , T , P , Chatarjee , A , P , Das.

Evaluation Pattern

External evaluation: Internal evaluation (70:30)

Theory:-External evaluation (70 Marks) Question Paper Pattern

Time: 2.5 hours

No.	Question Pattern	Marks
Q.1	a) Fill in the blanks by choosing appropriate options (5 MCQs) b) Answer in one /two sentences	05 05
Q.2	Answer any two. (based on Unit I) a) Long Answer Question b) Long Answer Question c) Long Answer Question d) Two short notes	20
Q.3	Answer any two. (based on Unit II) a) Long Answer Question b) Long Answer Question c) Long Answer Question d) Two short notes	20
Q.4	Answer any two. (based on Unit III) a) Long Answer Question b) Long Answer Question c) Long Answer Question d) Two short notes	20
Total		70

Theory:-Internal evaluation (30 Marks)

Description	Marks
Test	10
Project/Presentation/Report	10
Overall Conductance	10
Total	30

Practical:- Internal evaluation (15 Marks)

Description	Marks
Performance in Regular Practicals with certified journal	10
Active participation in Botanical Excursion	05
Total	15

**Practical:- External evaluation (35 Marks) Question Paper Pattern for SEM III
Practical Paper I**

No.	Question Pattern	Marks
Q.1	Identify, Classify and Describe the given Specimen A	07
Q.2	Identify, Classify and Describe the given Specimen B	07
Q.3	Identify, Classify and Describe Family C. Write floral formula	07
Q.4	Identify and describe given Spot D, E and F	09
Q.5	Viva-voce	05
Total		35

Specimen A: *Sargassum*

Specimen B: *Anthceros/Funaria*

Specimen C: Any Family

Spots D, E, F: Any spots related to any experiment not covered in above questions

**Practical:- External evaluation (35 Marks) Question Paper Pattern for SEM IV
Practical Paper I**

No.	Question Pattern	Marks
Q.1	Identify, Classify and Describe the given Specimen A	07
Q.2	Identify, Classify and Describe the given Specimen B	07
Q.3	Identify, Classify and Describe the given Specimen C	07
Q.4	Identify and describe given Spot D, E and F	09
Q.5	Viva-voce	05
Total		35

Specimen A: *Agaricus/Xylaria*

Specimen B: *Selaginella*

Specimen C: *Pinus*

Spots D, E, F: Any spots related to any experiment not covered in above questions

**Practical: - External evaluation (35 Marks) Question Paper Pattern for SEM III
Practical Paper II**

No.	Question Pattern	Marks
Q.1	Identify and Describe any one stage of Mitosis/Meiosis from the given Specimen A	07
Q.2	Identify and Describe the Inheritance pattern from given Specimen B	07
Q.3	Determine the sequence of Amino Acids from given Specimen C	07
Q.4	Identify and describe given Spot D, E and F	09
Q.5	Viva-voce	05
Total		35

Specimen A: *Mitosis*- Onion/Garlic root tips,

Meiosis- Onion flower buds

Specimen B: *Mirabilis jalapa* Leaves

Specimen C: m-RNA of Prokaryotes/Eukaryotes

Spots D, E, F: Any spots related to any experiment not covered in above questions

**Practical: - External evaluation (35 Marks) Question Paper Pattern for SEM IV
Practical Paper II**

No.	Question Pattern	Marks
Q.1	Identify and Describe the Mechanical tissues from given Specimen A	07
Q.2	Estimate the amount of Proteins by Lowry's method from given Specimen B	07
Q.3	Mechanically separate and Identify the pH of given soil Sample C	07
Q.4	Identify and describe given Spot D, E and F	09
Q.5	Viva-voce	05
Total		35

Specimen A: Stem/Root

Specimen B: Egg albumin/Protein extracted from pulses

Specimen C: Soil Samples from various localities

Spots D, E, F: Any spots related to any experiment not covered in above questions

**Practical: - External evaluation (35 Marks) Question Paper Pattern for SEM III
Practical Paper III**

No.	Question Pattern	Marks
Q.1	Identify and Describe the given Specimen A	07
Q.2	Identify and Describe the given Specimen B	07
Q.3	Determine the Neutraceutical value of given Specimen C	07
Q.4	Identify and describe given Spot D, E and F	09
Q.5	Viva-voce	05
Total		35

Specimen A: Any forest types found in India

Specimen B: *Saraca asoka/Terminalia arjuna*

Specimen C: Mushroom/Wheat germ

Spots D, E, F: Any spots related to any experiment not covered in above questions

**Practical: - External evaluation (35 Marks) Question Paper Pattern for SEM IV
Practical Paper III**

No.	Question Pattern	Marks
Q.1	Identify and Describe the given Specimen A	07
Q.2	Identify and Describe the given sterilization method from Specimen B	07
Q.3	Calculate the Coefficient of Correlation from given data C	07
Q.4	Identify and describe given Spot D, E and F	09
Q.5	Viva-voce	05
Total		35

Specimen A: Plants used in various garden locations

Specimen B: Autoclave/Hot Air Oven/Chemicals used in sterilization

Specimen C: Data taken in Practicals

Spots D, E, F: Any spots related to any experiment not covered in above questions

Expected Learning Outcomes

(Programme Outcomes, Programme Specific Outcomes, Course Outcomes)

B.Sc. Botany

Programme Outcomes

PO1. Knowledge and understanding of: 1. The range of plant diversity in terms of structure, function and environmental relationships. 2. Plant classification. 3. Plant pathology and physiology. 4. Genetics and biotechnology 5. The role of plants in the functioning of the global ecosystem. 6. Statistics as applied to biological data. 7. Modern techniques to study plants 8. Current trends in plant sciences

PO2. Intellectual skills Students able to: 1. Think logically and organize tasks into a structured form. 2. Assimilate knowledge and ideas based on wide reading and through the internet. 3. Transfer of appropriate knowledge and methods from one topic to another within the subject. 4. Understand the evolving state of knowledge in a rapidly developing field. 5. Construct and test hypothesis. 6. Plan, conduct and write a report on an independent term project.

PO3. Practical skills: Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them depending on their choice of optional modules. 1. Interpreting plant morphology and anatomy. 2. Plant identification. 3. Vegetation analysis techniques. 4. A range of physiochemical analyses of plant materials in the context of plant physiology and biochemistry. 5. Analyze data using appropriate statistical methods. 6. Plant pathology to be added for sharing of field and lab data obtained.

PO4. Transferable skills: 1. Use of IT (word-processing, use of internet, statistical packages and databases). 2. Communication of scientific ideas in writing and orally. 3. Ability to work as part of a team. 4. Ability to use library resources. 5. Time management. 6. Career planning.

PO5. Scientific Knowledge: Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyze any plant form.

PO6. Problem analysis: Identify the taxonomic position of plants, formulate the research literature, and analyze non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

PO7. Design/development of solutions: Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health.

PO8. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and development of the information to provide valid conclusions.

PO9. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.

PO10. The Botanist and society, Effective Citizenship: Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.

PO11. Environment and sustainability: Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO12. Ethics: Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.

PO13. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO14. Communication: Communicate effectively on complex forms and functions of plants with Botanists community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO15. Self-directed and Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of plant study.

Programme Specific Outcomes: (PSO)s of B.Sc. Botany:

PSO 1. Critically evaluation of ideas and arguments by collection relevant information about the plants, so as recognize the position of plant in the broad classification and phylogenetic level.

PSO 2. Identify problems and independently propose solutions using creative approaches, acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.

PSO 3. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of plant in taxonomy.

PSO 4. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses.

PSO 5. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that recommended for research.

PSO 6. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works.

PSO 7. Students will be able to apply fundamental mathematical tools (statistics, calculus) and physical principles (physics, chemistry) to the analysis of relevant biological situations.

PSO 8. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plant groups, and differentiate them from each other and from other forms of life.

PSO 9. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and life history.

PSO 10. Students will be able to explain how Plants function at the level of the gene, genome, cell, tissue, Flower development. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and mode of life cycle followed by different forms of plants.

PSO 11. Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.

PSO 12. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

Course Outcomes of B.Sc. Botany

After completion of course following learning outcomes are expected.

Students will learn and understand the syllabus.