



# **Sir P. T. Sarvajani College of Science**

**(Autonomous, Affiliated with VNSGU, Surat)**

**Re-Accredited 'A+' with CGPA 3.35**

**PROPOSED**

**SYLLABUS**

**FOR**

**SEM I & II**

**Program: B.Sc.**

**Course: Botany**

**From**

**Academic year**

**2024-25**

**(NEP-2020)**

**(To be effective from June, 2024)**



## **Acknowledgement**

At the outset, I would like to thank Principal Dr. Pruthul R Desai for his guidance and support during the curriculum restructuring process. I am also grateful to all the esteemed members of the Board of Studies, for their constructive suggestions and contributions.

Above all, I am deeply indebted to all the young and vibrant colleagues in the Department of Botany for the long and arduous work they have put in during the compiling of the restructured syllabus.

**Dr Anjali V Varshney**

**Chairperson**

**Board of Studies in Botany**



## Graduate Attributes

After the successful completion of modules in different courses of B.Sc. BOTANY, the learner will be able to:

**GA 1:** Understand the basic concept of botany in relation to its allied core courses.

**GA 2:** Perceive the significance of microbes and plants for the animal life, human welfare, and structural and functional aspects of plants.

**GA 3:** Demonstrate simple experiments related to plant sciences, analyse data, and interpret them with the theoretical knowledge.

**GA 4:** Appraise the students about the diversity of lower plants, their classification, structure and growth.

**GA 5:** Acquaint the students with the fundamentals and present understanding of the mechanisms associated with development, differentiation and structure of different plant organs and the metabolic and physiological changes occurring in them.

**GA 6:** Effectively communicate scientific ideas both orally and in writing.

## Programme Specific Outcomes

**PO - 1** To build a strong academic bridge.

**PO - 2** To provide flexibility in the course offered and proactively adapt to the changing needs of students and the society.

**PO - 3** To establish a centre for multidisciplinary activities.

**PO -4** To mould individuals who would nurture the cultural heritage of our country and contribute to the betterment of the society.



**Board of studies in Botany**  
**Undergraduate and Post graduate**

	Name	Designation	Institute/Industry
<b>Head of the Department</b>			
1	Dr. Anjali V Varshney	Chairman	Sir P T Sarvajani College of Science, Surat
<b>Faculty of the specialisation</b>			
1	Dr. Jayshri D Chaudhari	Assistant Professor	Sir P T Sarvajani College of Science, Surat
2	Dr. Vibhavari K Vyas	Adhyapak Sahayak	Sir P T Sarvajani College of Science, Surat
3	Dr. Jagruti S Rana	Adhyapak Sahayak	Sir P T Sarvajani College of Science, Surat
<b>Subject Expert nominated by Vice-Chancellor Subject experts</b>			
1	Dr. Meghna Adhwaryu	Head of the Department	Govt Arts, Commerce & Science College, Limbayat, Surat
<b>Representative from Industry/corporate sector/allied area</b>			
1	Ms. Prabhuta Patel	Director – Vision & Robotics	At Po. Ambach, F. Vaghshar, Ta. Pardi, Dist. Valsad, Gujarat
<b>Meritorious Alumnus</b>			
1	Dr. Minoo H Parabia	Start-up	Retired professor VNSGU 12/1768 A, Vakil Street, Shahpore, Surat
<b>Two experts from other than the parent University</b>			
1	Dr Lolly M. Jain	Associate Professor	K. J. Somaiya College of Science and Commerce, Mumbai
2	Prof. Bandu Konde	Professor	Wilson College (Autonomous), Mumbai



## Content

Sr. No	Semester	Course number	Course Code	Course title
<b>Core Course (CC)</b>				
1.	<b>I</b>	CC I [MJ]	BO-MJ-101	Prokaryotes, Phycology and Mycology
2.		CC II [MJ]	BO-MJ-102	Physiology, Anatomy and morphology
3.		PRACTICAL [MJ]	BOP-MJ-101 & 102	Practical (MJ)-1
4.		CC I [MI]	BO-MI-101	Basic Botany
5.		PRACTICAL [MI]	BOP-MI-101	Practical (MI)-1
6.		MDC	BO-MDC-101	Nursery Management and gardening
7.		PRACTICAL	BOP-MDC-101	Practical (MDC)-1
8.		SEC	BO-SEC-101	Bonsai Technique
9.		PRACTICAL	BOP-SEC-101	Practical (SEC)-1
10.		<b>IKS</b>		
1.	<b>II</b>	CC III [MJ]	BO-MJ-201	Higher cryptogams
2.		CC IV [MJ]	BO-MJ-202	Flowering plants and Systematics
3.		PRACTICAL [MJ]	BO-MJ-201 & 202	Practical (MJ)-2
4.		CC I [MI]	BO-MI-201	Higher cryptogams and Phanerogams
5.		PRACTICAL [MI]	BOP-MI-201	Practical (MI)-2
6.		MDC	BO-MDC-201	Ethnobotany, Pharmacognosy and Economic Botany
7.		PRACTICAL	BOP-SEC-201	Practical (MDC)-2
8.		SEC	BO-SEC201	Basics of crude herbal drugs
9.		PRACTICAL	BOP-SEC-201	Practical (SEC)-2
10.		<b>VAC</b>		



## Detailed B.Sc. Botany Syllabus

### F. Y. B.Sc. Syllabus with effect from the Academic year 2024-25

Course No.	Course Title	Course Code	Credits	Hour	Module	Lectures per module (1 Hr)	Examination		
							Internal Marks	External Marks	Total Marks
<b>SEMESTER I</b>									
<b>Major Courses THEORY</b>									
I	Prokaryotes, Phycology and Mycology	BO-MJ-101	3	45	3	15	35	35	70
II	Physiology, Anatomy and morphology	BO-MJ-102	3	45	3	15	35	35	70
<b>Major Courses PRACTICAL</b>									
I	Practical (MJ)	BOP-MJ-101 & 102	2	60	2	30	30	30	60
<b>Minor Courses THEORY</b>									
I	Basic Botany	BO-MI-101	2	30	2	15	20	20	50
<b>Minor Courses PRACTICAL</b>									
I	Practical (MI)	BOP-MI-101	2	60	2	30	25	25	50
<b>Multidisciplinary (MDC) THEORY</b>									
I	Nursery Management and Gardening	BO-MDC-101	2	30	2	15	25	25	50
<b>Multidisciplinary (MDC) PRACTICAL</b>									
I	Practical (MDC)	BOP-MDC-101	2	60	2	30	25	25	50
<b>Skill Enhance Course (SEC) THEORY</b>									
I	Bonsai Techniques	BO-SEC-101	1	15	1	15	13	13	26
<b>Skill Enhance Course (SEC) PRACTICAL</b>									
I	Practical (SEC)	BOP-SEC-101	1	60	1	30	12	12	24
<b>Vocational Skill Course (IKS)</b>									
I	IKS		2	30	2	15	25	25	50
<b>SEMESTER II</b>									
<b>Major Courses THEORY</b>									



III	Higher cryptogams	BO-MJ-201	3	45	3	15	35	35	70
IV	Flowering plants and Systematics	BO-MJ-202	3	45	3	15	35	35	70
<b>Major Courses PRACTICAL</b>									
II	Practical (MJ)-2	BO-MJ-201	2	60	2	30	30	30	60
<b>Minor Courses THEORY</b>									
II	Higher cryptogams and Phanerogams	BO-MI-201	2	30	2	15	20	20	50
<b>Minor Courses PRACTICAL</b>									
II	Practical (MI)-2	BOP-MI-201	2	60	2	30	25	25	50
<b>Multidisciplinary (MDC) THEORY</b>									
I	Ethnobotany, Pharmacognosy and Economic botany	BO-MDC-201	2	30	2	15	25	25	50
<b>Multidisciplinary (MDC) PRACTICAL</b>									
I	Practical (MDC)	BOP-MDC-201	2	60	2	30	25	25	50
<b>Skill Enhance Course (SEC) THEORY</b>									
I	Basics of crude herbal drugs	BO-SEC-201	1	15	1	15	13	13	26
<b>Skill Enhance Course (SEC) PRACTICAL</b>									
I	Practical (SEC)	BOP-SEC-201	1	60	1	30	12	12	24
<b>Vocational Skill Course (VSC)</b>									
II	VAC		2	30	2	15	25	25	50



## B.Sc. (BOTANY) SEMESTER- I

### CORE COURSE- I

### MAJOR COURSE (THEORY)

**COURSE TITLE: Prokaryotes, Phycology and Mycology**

**COURSE CODE: BO-MJ-101**

**[CREDITS - 03]**

Course learning outcome		
After the successful completion of the Course, the learner will be able to:		
<ol style="list-style-type: none"><li>1. Acquire a comprehensive knowledge on different aspects related to microbes and lower plants.</li><li>2. Ascertain latest developments in the field of Plant science with a practical approach.</li><li>3. Equip students to think independently, critically to discuss different aspects of plant life.</li></ol>		
<b>Module 1</b>	<b>Microbes</b>	<b>[15L]</b>
<b>Learning objectives:</b>		
The module is intended to		
<ul style="list-style-type: none"><li>● Ascertain the origins of life on the earth.</li><li>● Evaluate the ecological, ethnic and economic value of Microbes (Virus and bacteria).</li><li>● Understand the need and basics of classification, learn range of structure and reproduction in microbes.</li></ul>		
<b>Learning outcomes:</b>		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"><li>1. Explain origins of life on the earth.</li><li>2. Illustrate diversity among the viruses and prokaryotic organisms and categorize them.</li><li>3. Evaluate the ecological, ethnic and economic value of Microbes, Virus and bacteria.</li></ol>		



1.1	<ul style="list-style-type: none"> <li>➤ General characters, structure and size.</li> <li>➤ Virus types based on genetic material, Viroid, Virions and Prions.</li> <li>➤ TMV and CaMV</li> <li>➤ Economic Importance of Viruses.</li> </ul>	[8L]
1.2	<ul style="list-style-type: none"> <li>➤ Cellular forms of Life.</li> <li>➤ Structure and reproduction (Binary fission, Budding, Fragmentation), Gram Staining.</li> <li>➤ Types and shapes of Bacteria.</li> <li>➤ Economic and Ecological Importance of Bacteria</li> </ul>	[7L]
<b>Module 2</b>	<b>Phycology</b>	<b>[15L]</b>
<p><b>Learning objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>● Understand the ecological, ethnic and economic value of Algae.</li> <li>● Understand the classification, structure and reproduction of Algae.</li> </ul>		
<p><b>Learning outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Describes the classification of algae based on the structure, reproduction and life cycles.</li> <li>2. Evaluate the ecological, ethnic and economic value of Algae.</li> <li>3. Enlist the algal products for human welfare.</li> </ol>		
2.1	<ul style="list-style-type: none"> <li>➤ Classification of algae by G.M. Smith.</li> <li>➤ General characters and Occurrence.</li> <li>➤ Thallus structure and reproduction of Cyanophyta and Chlorophyta.</li> </ul>	[10L]
2.2	<ul style="list-style-type: none"> <li>➤ Life cycle of <i>Nostoc and Spirogyra</i>.</li> <li>➤ Economic and Ecological Importance of Algae</li> </ul>	[5L]
<b>Module3</b>	<b>Mycology</b>	<b>[15L]</b>
<p><b>Learning objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>● Understand the ecological, ethnic and economic value of Fungi</li> <li>● Understand the classification, structure and reproduction of Fungi</li> </ul>		
<p><b>Learning outcomes:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Classify the Fungi based on their structure, reproduction and life cycles.</li> </ol>		



<p>2. Evaluate the ecological, ethnic, and economic value of Fungi. Fungi are summarized for their importance to human life.</p> <p>3. Acquaint with fungal products useful to human beings.</p>		
3.1	<ul style="list-style-type: none"> <li>➤ Classification of Fungi by C.J. Alexopoulos</li> <li>➤ General characters, Occurrence, Thallus structure and reproduction of fungi.</li> </ul>	[8L]
3.2	<ul style="list-style-type: none"> <li>➤ General characters zygomycetes and basidiomycetes.</li> <li>➤ Life cycle of <i>Mucor and Agaricus</i></li> <li>➤ Economic and Ecological Importance of fungi.</li> </ul>	[7L]
<p><b>References:</b></p> <ul style="list-style-type: none"> <li>• A.C.Datta(1964) Botany for Degree Student, Oxford University press</li> <li>• Das Datta and Gangulee,(1990)College Botany Volume-I, 5<sup>th</sup> Edition New central book agency Calcutta</li> <li>• Gangulee and Kar ,(1990)College Botany Volume-II, New central book agency Calcutta</li> <li>• Mukharjee,(1990)College Botany Volume-III, New central book agency Calcutta</li> <li>• A. C. Datta(1989) College Botany 3rd Edi Oxford Bombay</li> <li>• G.M. Smith(1955) Cryptogamic Botany Vol. I – II, Tata McGraw Hill Bombay</li> <li>• Pandey S.N. and Trivedi P.S(2015) A text book of Botany vol. I( Algae, Fungi, Bacteria, Viruses, Lichen &amp; Plant pathology)12<sup>th</sup> Edition, Vikash publishing House pvt. Ltd., New Delhi</li> <li>• K.P. Saxena (1965) A Brief Course in Algae,,Prakashan Kendra, Lucknow.</li> <li>• S. Sundara Rajan.(2001) Introduction to Fungi 1st Edition Anmol Publication, New Delhi</li> <li>• Pandey B P (2011). College Botany -Vol. III. S. Chand &amp; Co. Ltd, New Delhi, India</li> <li>• P.C. Vashishta(1960) Botany for Degree Student: algae, S Chand publication Delhi</li> <li>• P.C. Vashishta(1960) Botany for Degree Student: fungi, S Chand publication Delhi</li> </ul>		



### Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the diversity among prokaryotes, algae and fungi.	X	X				
2. Explain the systematic structure of prokaryotes, algae and fungi.	X					
3. Student will be able to explain the useful and harmful activities of prokaryotes.	X	X			X	
4. Student will be able to cite specific examples of different types of prokaryotes, algae and fungi.	X	X			X	



## Question Paper Template

### B. Sc. (BOTANY) SEMESTER I

#### Core Course- I

**COURSE TITLE: Prokaryotes, Phycology and Mycology**

**COURSE CODE: BO-MJ-101**

**[CREDITS - 03]**

Module	Remembering/ Knowledge	Understanding	Applying	Analyzing	Evaluating	Creating	Total marks
I	3	4	-	-	4	-	11
II	3	5			4		12
III	3	5			4		12
Total marks per objective	9	14			12		35
% Weightage	26%	40%			34%		100%

### B.Sc. (BOTANY) SEMESTER- I

#### CORE COURSE- I1

#### MAJOR COURSE (THEORY)

**COURSE TITLE: Physiology, Anatomy and Morphology**

**COURSE CODE: BO-MJ-102**

**[CREDITS - 03]**

#### Course learning outcome

After the successful completion of the Course, the learner will be able to:

1. Perceive the significance of plants for human welfare cultivate insight into the structural and functional aspects of plants.
2. Demonstrate simple experiments related to plant sciences, analyze data, and interpret them.
3. Elaborate on the diversity of lower plants, their classification, structure, and growth.
4. Evaluate the metabolic, physiological and developmental changes occurring in plants.



Module 1	Physiology	[15L]
<p><b>Learning objectives:</b></p> <p>The module is intended to</p> <ul style="list-style-type: none"> <li>• Deliver knowledge on the latest developments in Plant sciences with a practical approach.</li> <li>• Equip students to think independently and critically to discuss different aspects of plant life.</li> </ul>		
<p><b>Learning outcomes:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Comprehend the importance of water in plant life and mechanisms for the absorption and transport of water and solutes in plants.</li> <li>2. Evaluate the role of minerals in plant nutrition and their deficiency symptoms.</li> <li>3. Critically understand the light reactions and carbon assimilation processes responsible for the synthesis of food in plants.</li> </ol>		
1.1	<p>➤ Definition, mechanism and importance of:</p> <ol style="list-style-type: none"> <li>1. Imbibition</li> <li>2. Osmosis</li> <li>3. Plasmolysis</li> <li>4. Plant movement</li> </ol>	[8L]
1.2	<p>➤ Definition, mechanism, and importance of:</p> <ol style="list-style-type: none"> <li>1. Transpiration</li> <li>2. Guttation.</li> </ol>	[7L]
Module 2	Anatomy	[15L]
<p><b>Learning objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• To impart basic knowledge about plant cells and tissue organisation in plant parts.</li> </ul>		
<p><b>Learning outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Understand the organization of tissues and tissue systems in plants.</li> <li>2. Evaluate and appreciate the different anatomical features in plants.</li> <li>3. Difference between Dicotyledons and Monocotyledons plants.</li> </ol>		
2.1	<p>➤ Definition, Types, and Structure of:</p> <ol style="list-style-type: none"> <li>1. Tissues</li> </ol> <p>➤ Difference between Dicotyledon and Monocotyledon Stem, Root and Leaf.</p>	[8L]



2.2	<ul style="list-style-type: none"> <li>• Definition, Types, structure and occurrence of:</li> <li>• Non-living cell inclusions (Ergastic material)</li> <li>➤ Definition, Types and structure of:             <ul style="list-style-type: none"> <li>• Stele</li> <li>• Vascular bundle</li> </ul> </li> </ul>	[7L]
<b>Module 3</b>	<b>Morphology of angiosperms</b>	<b>[15L]</b>
<p><b>Learning objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• Introduce a vision to look at the different plant part arrangement and their structure.</li> </ul>		
<p><b>Learning outcomes:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Critically understand different taxonomical aids for the identification and classification of Angiosperms.</li> <li>2. Analyse the morphology of the common Angiospermic plants.</li> <li>3. Appreciate variations in the roots, stems and leaves of plants and ability to describe them.</li> </ol>		
3.1	<ul style="list-style-type: none"> <li>➤ General and distinguishing characters of Angiosperms.</li> <li>➤ <b>Root-</b> Types, Functions and modifications of root.</li> <li>➤ <b>Stem-</b> Types, functions and Modifications of stem.</li> </ul>	[07]
3.2	<ul style="list-style-type: none"> <li>➤ <b>Leaf-</b> Definition, Structure, function and types.</li> <li>➤ <b>Venation</b> – Types.</li> <li><b>Phyllotaxy-</b> Definition and types.</li> </ul>	[8L]
<p><b>References:</b></p> <ul style="list-style-type: none"> <li>• V. Singh (1981) 1st Edi Taxonomy of Angiosperms: Rastogi pub.</li> <li>• B.P. Pandey(2001) Taxonomy of Angiosperm: S.Chand</li> <li>• Dr. S.K.Verma and Mohit Verma(2008) A textbook of Plant Physiology Biochemistry and Biotechnology: S. Chand and Co.</li> <li>• A.C. Datta(1989) College Botany,3rd Edi. Oxford Bombay.</li> <li>• B.P. Pandey(2001) Plant Anatomy: S. Chand and Co</li> </ul>		



### Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the structures and functions in plants.	X	X			X	
2. Explain the anatomical characters of the dicot and monocot plant	X	X			X	
3. Acquire ability to describe the morphological characters of a plant in hand.	X	X			X	
4. Shall be able to ascertain the types of arrangement of plant part in a given sample.	X	X			X	



### Question Paper Template

### B. Sc. (BOTANY) SEMESTER I

### Core Course- II

**COURSE TITLE: Physiology, Anatomy and Morphology**

**COURSE CODE: BO-MJ-102**

**[CREDITS - 03]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	3	4	-	-	4	-	11
II	3	5			4		12
III	3	5			4		12
Total marks per objective	9	14			12		35
% Weightage	26%	40%			34%		100%

### B.Sc. (BOTANY) SEMESTER I

### COURSE TITLE: PRACTICAL (MJ-I & II)

**COURSE CODE: BOP-MJ- 101 and 102**

**[CREDIT- 02]**

#### Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Demonstrate practical skills and relate their Botany theory concepts through practicals.
2. Differentiated different types of bacteria and viruses.
3. Identify and describe morphological, anatomical, and reproductive features of algae and fungi.
4. Explain the internal organization and functioning of various plant tissue system

#### PRACTICAL Module – I (course – I)

1	Study of Microscope.
2	Study the structure of TMV and CaMV with the help of a chart.
3	Study different types of bacteria with the help of a chart.
4	Study gram staining technique using available bacterial samples.
5	Study different types of stains and fixatives.
6	To analyze living organisms in pond water samples.
7	<b>A.</b> Study the thallus structure and reproduction in <i>Nostoc</i> . <b>B.</b> Study the permanent slides of <i>Nostoc</i> .



8	<b>A.</b> Study the thallus structure and reproduction in <i>Spirogyra</i> . <b>B.</b> Study the permanent slides of <i>Spirogyra</i> .
9	<b>A.</b> Study the thallus structure and reproduction in <i>Mucor</i> . <b>B.</b> Study the permanent slides of <i>Mucor</i> .
10	<b>A.</b> Study the thallus structure and reproduction in <i>Agaricus</i> . <b>B.</b> study the permanent slides of <i>Agaricus</i> .
11	Collection of algae and fungi during field visit.

### PRACTICAL Module - II (Course – II)

1	Perform Physiological experiments to demonstrate. <b>A.</b> Force of imbibition. <b>B.</b> Osmosis by thistle funnel method. <b>C.</b> Geotropic movement in plants. <b>D.</b> Hydrotropic movement in plants. <b>E.</b> Phototropic movement in plants. <b>F.</b> Stomatal transpiration by four leaves method. <b>G.</b> Phenomenon of transpiration (bell jar method).
2	Ascertain the relative rate of photosynthesis by bubble counting method.
3	Study different types of tissues by permanent slides.
4	Study the internal structure of Monocotyledon stem.
5	Study the internal structure of Dicotyledon stem.
6	Study the internal structure of Monocotyledon root.
7	Study the internal structure of Dicotyledon root.
8	Study the internal structure of Monocotyledon leaf
9	Study the internal structure of Dicotyledon leaf.
10	Study ergastic matters in different plant materials.



11	<p><b>Study the different types of root:</b></p> <p>a. Types of roots</p> <ul style="list-style-type: none"><li>• Tap roots (<i>Vinca</i>)</li><li>• Fibrous Roots (Grass)</li><li>• Adventitious (Bryophyllum)</li></ul> <p>b. Modified roots:</p> <ul style="list-style-type: none"><li>• Prop roots (Banyan tree)</li><li>• Stilt root (Maize and Sugarcane)</li><li>• Pneumatophores (<i>Avicennia</i>)</li><li>• Storage roots (Carrot and Sweet Potato)</li></ul>	
12	<p><b>Study the different types of stem:</b> (any of the types as per the availability)</p> <p>a. Aerial Stems-</p> <ul style="list-style-type: none"><li>• Caudex (Palms)</li><li>• Culm (Bamboo)</li><li>• Scape (Canna and Onions)</li><li>• Excurrent (<i>Polyalthia longifolia and Casuarina</i>)</li><li>• Deliquescent (Mango)</li><li>• Weak Stem (<i>Ipomoea</i>)</li></ul> <p>b. Underground Stems:</p> <ul style="list-style-type: none"><li>• Rhizome (Ginger, turmeric)</li><li>• Tuber (Potato)</li><li>• Bulb (Onion)</li><li>• Corm (<i>Amorphophallus</i>)</li></ul> <p>c. Specialized Stem:</p> <ul style="list-style-type: none"><li>• Phylloclade (<i>Opuntia</i>)</li><li>• Cladode (<i>Asparagus</i>)</li></ul>	
13	<p><b>Study the different types of leaf:</b> (any of the types as per the availability)</p> <p>a. Simple (Mango and Banana)</p> <p>b. Pinnate Compound Leaf</p> <ol style="list-style-type: none"><li>1. Unipinnate (Cassia and Rose)</li><li>2. Bipinnate (<i>Mimosa and Caesalpinia</i>)</li><li>3. Tripinnate (<i>Moringa</i>)</li><li>4. Decompound (<i>Coriander</i>)</li></ol> <p>c. Palmately Compound Leaf</p> <ol style="list-style-type: none"><li>1. Unifoliate (<i>Citrus</i>),</li><li>2. Bifoliate (Balanites and Bauhinia)</li><li>3. Trifoliate (<i>Crotalaria and Oxalis</i>)</li><li>4. Quadrifoliate (<i>Marsilea</i>)</li><li>5. Multifoliate (<i>Bombax</i>)</li></ol>	



14 **Study the phyl]otaxy of the following types:**

1. Alternate: (*Hibiscus rosa sinensis*)
2. Opposite Superpose: (*Quisqualis indica*)
3. Opposite Decussate: (*Calotropis procera*)
4. Verticillate or Whorled: (*Nerium and Alstonia*)

- Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidate shall produce a certified journal during the practical examination.

**B.Sc. (BOTANY) SEMESTER I**

**MINOR COURSE THEORY**

**COURSE TITLE: BASIC BOTANY**

**COURSE CODE: BO-MI-101**

**[CREDITS - 02]**

**Course learning outcome**

After the successful completion of the Botany Minor Course, the learner will be able to:

- Acquaint themselves with viruses, bacteria, algae and fungi.
- Describe the morphology of angiospermic plants.

**Module 1**

**Prokaryotes and eukaryotes**

**[15L]**

**Learning objectives:**

The module is intended to

- Impart a thorough knowledge of general characters and classification of algae
- Obtain a vivid insight of thallus structure and the Life cycle of Nostoc.
- Acquire knowledge about general characters and classification of fungi.
- Get information about thallus structure and the Life cycle of Mucor.

**Learning outcomes:**

After the successful completion of the module, the learner will be able to

1. Explain the origins of life on the earth.



2. Appreciate and categorize diversity among the viruses and prokaryotic organisms. 3. Evaluate the ecological, ethnic and economic value of Microbes, Algae and Fungi. 4. Summarizing their importance in human welfare. 5. Classify algae based on their structure, reproduction and life cycles.		
1.1	➤ <b>Virus:</b> <ul style="list-style-type: none"> <li>• General characters.</li> <li>• Economic importance.</li> </ul>	[3L]
1.2	➤ <b>Bacteria:</b> <ul style="list-style-type: none"> <li>• General Characters.</li> <li>• Economic Importance.</li> </ul>	[3L]
1.3	➤ <b>Algae:</b> <ul style="list-style-type: none"> <li>• General characters.</li> <li>• Classification given by G.M. Smith.</li> <li>• Classification, Occurrence, Thallus structure and Life cycle of <b>Nostoc</b>.</li> </ul>	[5L]
1.4	➤ <b>Fungi:</b> <ul style="list-style-type: none"> <li>• General characters.</li> <li>• Classification given by C.J. Alexopoulos.</li> <li>• Classification, Occurrence, Thallus structure, and Life cycle of <b>Mucor</b>.</li> </ul>	[4L]
<b>Module 2</b>	<b>Morphology of angiosperms</b>	<b>[15L]</b>
<b>Learning objectives:</b> This module is intended to <ul style="list-style-type: none"> <li>• Be aware of the importance of the different types of characters in Angiosperm/taxonomy.</li> <li>• Acquire knowledge of the morphology of the most common Angiosperm plants.</li> <li>• Gain knowledge about morphology and modification of stem, root, and leaf</li> </ul>		
<b>Learning outcome:</b> After the successful completion of the module, the learner will be able to <ol style="list-style-type: none"> <li>1. Understand need of different taxonomic aids for the identification of Angiosperms.</li> <li>2. Analyze the morphology of the common Angiosperm plants.</li> <li>3. Identify types of Root, Stem and Leaf.</li> </ol>		
2.1	➤ <b>Angiosperm-</b> General and distinguishing characters of Angiosperms.	[3L]



2.2	➤ <b>Root-</b> Parts, Types, Functions and modifications.	[4L]
2.3	➤ <b>Stem-</b> Types, function and modifications.	[4L]
2.4	➤ Definition, structure, function and types of: <ul style="list-style-type: none"><li>• Leaf</li><li>• Venation</li><li>• Phyllotaxy</li></ul>	[4L]

#### References:

- A.C.Datta(1964). Botany for Degree Student. Oxford University press
- Das Datta and Gangulee,(1990).College Botany Volume-I.5<sup>th</sup> Edition New central book agency Calcutta
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### Question Paper Template

F.Y. B. Sc. (BOTANY) SEMESTER I

MINOR BOTANY (THEORY)

COURSE TITLE: BASIC BOTANY

COURSE CODE: **BO-MI-101**

[CREDITS - 02]

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	3	6	--	3	--	--	12
II	3	6	--	4	--	--	13
Total marks per objective	06	12		07			25
% Weightage	24%	48%		28%			100%

#### Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the diversity among prokaryotes, algae and fungi and their physiology and anatomy.	X	X			X	
2. Grasp the systematic structure of prokaryotes, algae, and fungi, and the Morphological characteristics of plants.	X	X			X	
3. Ascertain knowledge on the useful and harmful interaction of prokaryotes, with mankind.	X	X			X	
4. First-hand knowledge on the different types of prokaryotes, algae and fungi, and plant part arrangements.	X	X			X	



## B.Sc. (BOTANY) SEMESTER I

### COURSE TITLE: PRACTICAL (MI)-I

COURSE CODE: **BOP MI-101**

[CREDIT- 02]

#### Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Use of Microscope in Biology
2. Life diversity within Pond water samples.
3. Macroscopic and microscopic appearance of bacteria, algae and fungi.
4. Interpreting plant morphology of angiospermic plants.

#### PRACTICAL Module – I (course – I)

1	Study of Microscope.
2	Study the structure of TMV and CaMV by the help of a chart.
3	Study bacteria in curd.
4	To analyze living organisms in pond water sample.
5	Study thallus structure, reproduction and permanent slides of <i>Nostoc</i> .
6	Study the habitat of fungi by field visit and collect any two fungi.
7	Study thallus structure, reproduction, permanent slides and cultural practice of <i>Mucor</i> at the laboratory.

#### PRACTICAL Module – II (course – I)

1	<b>Study different types of root:</b> <b>a. Types of roots:</b> <ul style="list-style-type: none"><li>• Tap roots (<i>Vinca</i>)</li><li>• Fibrous Roots (Grass)</li><li>• Adventitious (Bryophyllum)</li></ul> <b>b. Modified roots:</b> <ul style="list-style-type: none"><li>• Prop roots (Banyan tree)</li><li>• Stilt root (Sugarcane)</li><li>• Pneumatophores (<i>Avicennia</i>)</li><li>• Storage roots (Carrot and Sweet Potato)</li></ul>
2	<b>Study different types of stem:</b> <b>a. Aerial Stems-</b> <ul style="list-style-type: none"><li>• Caudex (Palms)</li><li>• Culms (Bamboo)</li><li>• Scape (<i>Canna</i> and onion)</li></ul>



3	<ul style="list-style-type: none"><li>• Excurrent (<i>Polyalthia longifolia</i>, <i>Casuarina</i>)</li><li>• Deliquescent (Mango)</li><li>• Weak Stem (<i>Ipomoea</i>)</li></ul> <p><b>b. Underground Stems:</b></p> <ul style="list-style-type: none"><li>• Rhizome (Ginger and turmeric)</li><li>• Tuber (Potato)</li><li>• Bulb (Onion)</li><li>• Corm (<i>Amorphophallus</i>)</li></ul> <p><b>c. Specialized Stem:</b></p> <ul style="list-style-type: none"><li>• Phylloclade (<i>Opuntia</i>)</li><li>• Cladode (<i>Asparagus</i>)</li></ul>
4	<p><b>To study different types of leaves:</b> (any of the type as per availability)</p> <p>a. Simple (Mango and Banana)</p> <p>b. Pinnate Compound Leaf:</p> <ol style="list-style-type: none"><li>I. Unipinnate (<i>Cassia</i> and Rose)</li><li>II. Bipinnate (<i>Mimosa</i> and <i>Caesalpinia</i>)</li><li>III. Tripinnate (<i>Moringa</i>)</li><li>IV. Decompound (<i>Coriander</i>)</li></ol> <p>c. Palmately Compound Leaf</p> <ol style="list-style-type: none"><li>I. Unifoliate (<i>Citrus</i>)</li><li>II. Bifoliate (<i>Balanites</i>)</li><li>III. Trifoliate (<i>Crotalaria</i> and <i>Oxalis</i>)</li><li>IV. Quadrifoliate (<i>Marsilea</i>)</li><li>V. Multifoliate (<i>Bombax</i>)</li></ol>
5	<p><b>To study phyllotaxy of the following type:</b></p> <ol style="list-style-type: none"><li>1. Alternate: (<i>Hibiscus</i>)</li><li>2. Opposite Superpose: (<i>Quisqualis indica</i>)</li><li>3. Opposite Decussate: (<i>Calotropis</i>)</li><li>4. Verticillate or Whorled: (<i>Nerium</i> and <i>Alstonia</i>)</li></ol>

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## B.Sc. (BOTANY) SEMESTER I

### Multidisciplinary

**COURSE TITLE: Nursery management and gardening**

**COURSE CODE: BO-MDC-101**

**[CREDITS - 02]**

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to:		
<ol style="list-style-type: none"><li>1. Propagate plants and develop the nursery on commercial basis.</li><li>2. Deal with the seed production technology of horticultural crops.</li><li>3. Cultivate plants in green house. (Types of green house, erection and management).</li><li>4. Get acquainted with the basics of ornamental, landscape gardening, evade Pests and Diseases.</li><li>5. Acquire knowledge regarding the theory and practice of the plant production.</li></ol>		
<b>Module 1</b>	<b>Nursery management</b>	<b>[15L]</b>
<b>Learning objectives:</b> The module is intended to <ul style="list-style-type: none"><li>• Impart basic knowledge and develop skills about propagating different types of plants by seed, cuttings, budding and grafting, separation, division, layering as well as micro-propagation in a commercially viable way.</li></ul>		
<b>Learning outcomes:</b> After the successful completion of the module, the learner will be able to <ol style="list-style-type: none"><li>1. Develop skills in propagating different types of plants by seed, cuttings, budding and grafting, separation, division, layering as well as micro-propagation in a commercially viable way.</li></ol>		
1.1	<ul style="list-style-type: none"><li>➤ Nursery: Definition, objectives, scope and Infrastructure of nursery.</li><li>➤ Planting - direct seedlings and transplants.</li></ul>	[5L]



1.2	<ul style="list-style-type: none"> <li>➤ Vegetative propagation: By plant parts.</li> <li>➤ Types of Air-layering, Cutting, Grafting and Budding,</li> <li>➤ Season for collection, Selection of cutting and Treatment of cutting.</li> <li>➤ Rooting media.</li> <li>➤ Uses of greenhouse for Vegetative Propagation.</li> <li>➤ Sowing/raising of seeds and seedlings - Transplanting of seedlings.</li> </ul>	[10L]
<b>Module 2 Gardening</b>		<b>[15L]</b>
<p><b>Learning objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• Impart basic knowledge about types of gardens, parks, plant material, design-computer applications in landscaping and production practices.</li> <li>• Develop and management of nursery business (financial, marketing and personnel).</li> </ul>		
<p><b>Learning outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Apply gained knowledge of field production nurseries, business development, garden management, site selection, financial aspects, legal regulations, and production practices (nutrition, water management, pest management, pruning and training, storage and handling, and shipping).</li> <li>2. Initiate entrepreneurial skills.</li> </ol>		
2.1	<ul style="list-style-type: none"> <li>➤ Definition, objectives and scope of gardening.</li> <li>➤ Types of Gardening, landscape and home gardening.</li> <li>➤ Parks and its components.</li> <li>➤ Plant materials and design-computer applications in landscaping.</li> </ul>	[7L]
2.2	<ul style="list-style-type: none"> <li>➤ Gardening operations: Soil laying and manuring.</li> <li>➤ Types and methods of manuring.</li> <li>➤ Types and methods of irrigation.</li> <li>➤ Management of pests, diseases and harvesting.</li> </ul>	[8L]



### References:

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- Ray, P.K. (2012). Plant Nursery Management: How to Start and Operate a Plant Nursery. Scientific Publishers.
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### Question Paper Template

#### B. Sc. (BOTANY) SEMESTER I

#### Multidisciplinary

**COURSE TITLE: Nursery management and gardening**

**COURSE CODE: BO-MDC-101**

**[CREDITS - 02]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	20	-	-	-	-	25
II	5	20	-	-	-	-	25
Total marks per Questions	10	40	-	-	-	-	50
% Weightage	20%	80%	-	-	-	-	100%



### Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the management and methods of nursery and gardening.	X	X				
2. Muster the process of propagation, manuring and irrigation.	X	X				
3. Students will be able to designing structure of gardens, park and landscaping.		X				
4. Students will be able to identify and select the taxa for the gardens.	X	X				



## B.Sc. (BOTANY) SEMESTER I

### Multidisciplinary (Practical)

**COURSE TITLE: Nursery management and Gardening**

**COURSE CODE: BOP- MDC- 101 [CREDIT- 02]**

#### Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Demonstrate practical skills.
2. Correlate their Botany theory concepts through practical.
3. Develop an understanding of nursery business management (financial, marketing, personnel).

#### PRACTICAL Module – I

1	Familiarize with the different tools and techniques of nursery management.
2	Make potting mixture and growth media.
3	Study seed-sowing methods in the nursery.
4	Study the vegetative propagation using plant parts.
5	Study the types of cutting.
6	Study the types of grafting.
7	Study the types of air-layering.

#### PRACTICAL Module – II

1	Study the nursery bed preparation.
2	Study the different types of fertilizer.
3	Study the nursery disease and its management.
4	Study of weeds and their uses.
5	Field visit report.

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## B.Sc. (BOTANY) SEMESTER I

### Skill Enhanced Course

#### COURSE TITLE: Bonsai technique

COURSE CODE: **BO-SEC- 101**

[CREDITS - 01]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand, importance and preliminary techniques about Bonsai.</li> <li>2. Need and method of maintaining Bonsai plants.</li> <li>3. Grasp the art of imaginative in bonsai making.</li> <li>4. Casting, remarking and promoting and aesthetic value of Bonsai.</li> <li>5. Develop insight ascertain the demand of commercial and ornamental types of bonsai.</li> <li>6. Recognize the traditions and ritual values of bonsai.</li> <li>7. Implement the acquired knowledge on commercial applications of Bonsai, on marketing practice of bonsai, and the marketing potential of bonsai in India and all over the world.</li> </ol>		
Module 1	Introduction and requirement	[15L]
<p><b>Learning objectives:</b></p> <p>The module is intended to</p> <ul style="list-style-type: none"> <li>• Elaborate on the history, scope and importance of Bonsai.</li> <li>• Impart knowledge about style, suitable plants, how to create and maintain, pruning, irrigation, pest and disease management of Bonsai.</li> </ul>		
<p><b>Learning outcomes:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Survey scope, importance, style, suitable plants and train users to maintain, pruning, irrigation, pest and disease management of Bonsai.</li> <li>2. Start-ups as employment, self-employment, and conservation of nature.</li> </ol>		
1.1	<p>➤ <b>Introduction</b> - history, aim, scope, and importance of Bonsai. Identification and collection of suitable plants for bonsai making.</p>	[5L]



	<ul style="list-style-type: none"> <li>➤ Tools, containers, wiring, and preparation of media.</li> <li>➤ Pruning techniques in bonsai making.</li> <li>➤ Irrigation method, pest and disease management.</li> </ul>	
1.2	<ul style="list-style-type: none"> <li>➤ <b>Styles of Bonsai</b> –               <ol style="list-style-type: none"> <li>1. Upright.</li> <li>2. Formal Upright.</li> <li>3. Informal Upright.</li> <li>4. Slanting.</li> <li>5. Windswept.</li> <li>6. Broom.</li> </ol> </li> <li>➤ <b>Cascade Styles of Bonsai</b> –               <ol style="list-style-type: none"> <li>1. Semi Cascade.</li> <li>2. Formal Cascade.</li> <li>3. Informal or Vertical Cascade.</li> <li>4. Displaying Cascade Style Bonsai.</li> </ol> </li> <li>➤ <b>Multiple tree styles of Bonsai</b> –               <ol style="list-style-type: none"> <li>1. Two-Tree and Twin Trunk Style Bonsai.</li> <li>2. Forest Style Bonsai. Bonsai with Special Characteristics.</li> </ol> </li> <li>➤ <b>Economic importance of Bonsai.</b></li> </ul>	[10L]
<p><b>References:</b></p> <ul style="list-style-type: none"> <li>• Chadha. K.L. and Bhattacharjee (1986). Ornamental Horticulture in India. ICAR.</li> <li>• Raj, D (2004). Ornamental Horticulture in India. ICA, New Delhi.</li> <li>• Randhawa, G. S. and Mukhopadhyay, A. (2010). Floriculture at Glancc. Kalyani Publisher Ludhiyana.</li> <li>• Randhawa, G. S. and Mukhopadhyay (1986).Floriculture in India.Allied publishers private limited. New Delhi.</li> <li>• Relf, D. (2015). The Art of Bonsai. Communications and Marketing, College of Agriculture and Life Sciences</li> <li>• Robert Smith (2022) Bonsai Book Forr Beginners. Jpinsider</li> <li>• Bose T.K. &amp; Mukhérjee, D.(1972) Gardening in India, Oxford &amp; IBH Publishing Co., New Delhi.</li> </ul>		



### Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the management and method of Bonsai making.	X	X	X			
2. Muster the process of different types and multiple tree types of Bonsai.	X	X	X			
3. Students will be able to design different types of Bonsai.		X				
4. Students will be able to use different tools and equipments for bonsai making.		X	X			



### Question Paper Template

### B. Sc. (BOTANY) SEMESTER I

### Skill Enhanced Course

### COURSE TITLE: Bonsai technique

COURSE CODE: **BO- SEC-101**

[CREDITS - 01]

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	10	10	-	-	-	25
Total marks per Questions	5	10	10	-	-	-	25
% Weightage	10%	45%	45%	-	-	-	100%

### B.Sc. (BOTANY) SEMESTER I

### Skill Enhanced Course

### COURSE TITLE: Bonsai Technique (Practical)

COURSE CODE: **BOP-SEC-101**

[CREDIT- 01]

#### Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Demonstrate practical skills.
2. Correlate their Botany theory concepts through practical.
3. Develop an understanding of nursery business management (finance, marketing and personnel).

#### PRACTICAL Module – I

1	Study different tools used in Bonsai by chart/specimens.
2	Study different styles of bonsai by chart/specimens.
3	Study different containers of Bonsai.
4	Perform wiring branches on Bonsai.
5	Perform clamping for shaping branch.



6	Study the potting and repotting of Bonsai.
7	Study the soil composition of Bonsai.
8	Selecting planting material viz. seeds, cuttings and overcome beginnings problems.
9	Study the watering and feeding of Bonsai.
10	Study the pest and disease of Bonsai.

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- At the end of the semester candidate shall produce a certified journal during the practical examination.