



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

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

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

**PROPOSED**

**SYLLABUS**

**FOR**

**SEM I & II**

**Program: M.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**



**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 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



<b>Program Specific Outcomes (PSOs)</b>	
After the successful completion of the Botany program, the students are expected to	
PSO1	Develop conceptual understanding of science and technology to foster the traditional and modern techniques for solving complex problems in Plant conservation.
PSO2	Be anxious about biodiversity conservation and environmental protection in context with public health, safety, cultural and societal development.
PSO3	Design and execute experiments using appropriate techniques, plant resources, and modern ICT tools for the conservation of natural resources.
PSO4	Apply the ethical principles and social responsibilities along with socio-economic development to understand the importance of the plant kingdom.
PSO5	Know the contextual knowledge in plant science research and communicate effectively with stakeholders with the society at large for enhancing the quality of life.

<b>Program Outcomes (POs)</b>	
On successful completion of the M. Sc. <b>Botany</b> program	
PO1	Apply the knowledge of Botany to find solution to routine as unique problems of life.
PO2	Ensure the use of contemporary tools and techniques in understanding the scope and significance of Botany.
PO3	Develop scientific problem-solving during experimentation, research projects, Analysis and interpretation of data.
PO4	Exploration of diverse plant life-forms and to nurture the conservation of Biodiversity.
PO5	Enhanced capacity to think critically; ability to design and execute experiments independently and/or team under multidisciplinary settings
PO6	Design and standardize protocols for public health and safety, and cultural, Societal, and environmental considerations.
PO7	Apply appropriate techniques, resources, and modern ICT tools the sustainable utilization of Plant resources.
PO8	Demonstrate the contextual knowledge in sustainable exploitation of medicinal, economically important and endangered plants as per the National Biodiversity Act.
PO9	Follow the concept of professional ethics and bioethics norms for practicing the value of the plant wealth.
PO10	Communicate proficiently with various stakeholders and society, to comprehend and to write and present reports effectively.



## Content

Sr. No	Semester	Course number	Course Code	Course title
<b>Core Course (CC)</b>				
1.	<b>I</b>	CC I [1001]	BO-1001	Diversity of Microorganisms
2.		CC II [1002]	BO-1002	Algae and Lichen
3.		CC III [1003]	BO-1003	Fungi and Plant Pathology
4.		Elective Paper [1004]	BO-EL-1004	Organic farming and Agronomy
5.		Skill based [1005]	BO-SKL-1005	1. Mushroom cultivation 2. Dry land Horticulture
6.		PRACTICAL	BOP-1006	Practical based on core paper I to III
1.	<b>II</b>	CC IV [2001]	BO-2001	Bryophyte and Pteridophyte
2.		CC V [2002]	BO-2002	Gymnosperms and Paleobotany
3.		CC VI [2003]	BO-2003	Plant anatomy and Embryology
4.		Elective Paper [2004]	BO-EL-2004	Biostatistics and Instrumentation
5.		Skill based [2005]	BO-SKL-2005	1. Pharmacognosy and Phytochemistry 2. Gardening
6.		PRACTICAL	BOP-2006	Practical based on core paper IV to VI



## Detailed M.Sc. Botany Syllabus

### M.Sc. Syllabus with effect from the Academic year 2024-25

Sr. 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>THEORY</b>									
I	Diversity of Microorganism	BO-1001	4	60	4	15	30	70	100
II	Algae and Lichen	BO-1002	4	60	4	15	30	70	100
III	Fungi and Plant Pathology	BO-1003	4	60	4	15	30	70	100
IV	Organic farming and Agronomy	BO-EL-1004	4	60	4	15	30	70	100
V	1. Mushroom cultivation 2. Dry land Horticulture	BO-SKL-1005	2	30	2	15	20	30	50
<b>PRACTICAL</b>									
VI	Practicals based on core paper I to III	BOP-1006	6	180	3	60	50	100	150
Total			24						600
<b>SEMESTER II</b>									
<b>THEORY</b>									
I	Bryophytes and Pteridophytes	BO-2001	4	60	4	15	30	70	100
II	Gymnosperms and Paleobotany	BO-2002	4	60	4	15	30	70	100
III	Plant Anatomy and Embryology	BO-2003	4	60	4	15	30	70	100



IV	Biostatistics and Instrumentation	BO-EL-2004	4	60	4	15	30	70	100
V	1. Pharmacognosy and Phytochemistry 2. Gardening	BO-SKL-2005	2	30	2	15	20	30	50
<b>PRACTICAL</b>									
II	Practicals based on core paper IV to VI	BOP-2006	6	180	3	60	50	100	150
Total			24						600



## M. Sc. (BOTANY) SEMESTER I

### CORE COURSE-1

#### COURSE TITLE: DIVERSITY OF MICROORGANISMS

COURSE CODE: **BO-1001**

[CREDITS - 04]

Course learning outcome		
<p>After the successful completion of the Botany Course, the learner will be able to:</p> <ul style="list-style-type: none"> <li>• Grasp the history of classification of microbes and plant development of plant pathology.</li> <li>• Illustrate the disease cycle of pathogens of plants.</li> <li>• Learn the processes of reproduction, adaptation, survival, and interaction of microorganisms with their associated hosts and environment.</li> <li>• Understand the theoretical basis of the tools, technologies and methods commonly used in microbiology and plant pathology.</li> <li>• Develop practical skills in the use of microbiological methodologies, tools and techniques.</li> <li>• Understand the role of microorganisms in the human life.</li> </ul>		
Module 1	History of virology, classification of virus	[15L]
<p><b>Learning objectives:</b> The module is intended to:</p> <ul style="list-style-type: none"> <li>• Learn the characters of Virus and its classification.</li> <li>• Acquire knowledge of the morphology of the common Viruses.</li> <li>• Gain knowledge about Virus pathology and host interaction.</li> </ul>		
<p><b>Learning outcomes</b> After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Understand the characters of virus their classification and morphology.</li> <li>2. Understand the different types of bacteria present in an environment.</li> <li>3. Characterize and culture Viruses present in different substrates using appropriate techniques.</li> <li>4. Understand the Economic and Industrial importance of Virus.</li> </ol>		
1.1	<ul style="list-style-type: none"> <li>➤ Pathological History and Timeline of Virology.</li> <li>➤ Classification of viruses.</li> <li>➤ Methods of transmission of viruses, properties of virus symptoms of viral infection on plants.</li> </ul>	[4L]
1.2	<ul style="list-style-type: none"> <li>➤ Bacteriophage.</li> <li>➤ Behavior of viruses in plants including infection, replication and movement.</li> <li>➤ Histopathological changes induced by viruses in plants, inclusion bodies.</li> </ul>	[6L]



1.3	<ul style="list-style-type: none"> <li>• Transmission of viruses: virus - vector relationships. Symptoms expression, viroids and prions.</li> <li>• Application of viruses in biotechnology.</li> </ul>	[5L]
<b>Module 2</b>	<b>Biology, reproduction &amp; growth modes of bacteria</b>	<b>[15L]</b>
<p><b>Learning objectives:</b> This module is intended to:</p> <ul style="list-style-type: none"> <li>• Learn about the various characters of bacteria and its classification.</li> <li>• Acquire knowledge of the morphology of the most common bacteria.</li> <li>• Gain knowledge about bacterial diseases, its pathogen and host.</li> </ul>		
<p><b>Learning outcome:</b> After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> <li>1. Grasp the characters of bacteria and its classification with their morphology.</li> <li>2. Learn to recognize the different types of bacteria present in an environment.</li> <li>3. Characterize and culture bacteria present in various substrates using appropriate techniques.</li> <li>4. Comprehend the range and potential of Economic and Industrial importance of Bacteria.</li> </ol>		
2.1	<ul style="list-style-type: none"> <li>➤ History of Bacteriology.</li> <li>➤ Detailed study of bacteria with morphology and general classification.</li> </ul>	[3L]
2.2	<ul style="list-style-type: none"> <li>➤ Ultra-Structure of Bacterial cell, cell Wall, flagella and it's Motility - Pili (fimbriae), capsules, sheaths, prosthecae and Stalks. The Cell Wall - Structure and Chemical Composition; cell membrane, nucleoid, ribosomes, and endospore.</li> </ul>	[4L]
2.3	<ul style="list-style-type: none"> <li>➤ Sexual Reproduction-Bacterial conjugation with sex factor. Growth-Normal Growth Cycle (Growth Curve) of Bacteria.</li> </ul>	[4L]
2.4	<ul style="list-style-type: none"> <li>➤ Diseases caused by plant pathogenic bacteria; entry of bacteria into plants; pathogenicity and virulence factors in bacterial diseases; plant response to bacterial infection; diagnosis of bacterial diseases and symptoms.</li> <li>➤ Industrial importance of Bacteria.</li> </ul>	[4L]
<b>Module 3</b>	<b>Methods in microbiology</b>	<b>[15L]</b>
<p><b>Learning objectives:</b> The module is intended to make student:</p> <ul style="list-style-type: none"> <li>• Use aseptic techniques for the transfer and handling of microorganisms and instruments.</li> <li>• Familiarize with appropriate biological media and test systems for microbiology</li> </ul>		



**Learning objectives:**

The module is intended to make student:

- Use aseptic techniques for the transfer and handling of microorganisms and instruments.
- Familiarize with appropriate biological media and test systems for microbiology.
- Understand the use of standard biology laboratory equipment correctly.
- Isolate microorganisms from soil, water and air.

**Learning outcome:**

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

1. Understand and recognize the different types of media and its uses.
2. Know of different stains, and dyes and culture media for microorganisms present in different substrates using appropriate techniques.
3. Understand the Enumeration of microorganisms in soil, water and air.

3.1	<ul style="list-style-type: none"> <li>➤ Microbiological Media.</li> <li>➤ Types, preparation, methods of sterilization.</li> </ul>	[4L]
3.2	<ul style="list-style-type: none"> <li>➤ Techniques of pure culture, maintenance and preservation, Stains and dyes.</li> <li>➤ Types of staining</li> </ul>	[4L]
3.3	<ul style="list-style-type: none"> <li>➤ Isolation of microorganisms from environment and infected plant tissue.</li> </ul>	[3L]
3.4	<ul style="list-style-type: none"> <li>➤ Enumeration of microorganisms in soil, water, and air.</li> </ul>	[4L]
<b>Module 4</b>	<b>Applied microbiology</b>	<b>[15L]</b>

**Learning objectives:**

The module is intended to:

- Explain the theoretical basis of the tools, technologies and methods commonly used in microbiology and plant pathology.
- Develop practical skills in the use microbiological methodologies, tools and techniques.
- To assess role of microorganisms in industrial processing of microbial products and as causative agents of plant diseases.
- To formulate methodologies and develop tools and techniques to isolate, characterize and effectively exploit the various microbiological processes for human welfare.

**Learning outcome:**

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

1. Recognize the different types of microorganisms present in a biosphere, environment and their importance.
2. Understand role of microorganisms in industrial processing of microbial products



and as causative agents of plant diseases recognize the different types of Media and their uses.

3. Use the different microbiological processes for human welfare.

4.1	<ul style="list-style-type: none"> <li>➤ Industrial Microbiology: Fermenters, batch fermentation vs continuous fermentation.</li> <li>➤ Industrial production of enzymes (cellulase, amylase and protease), amino acids (glutamic acid and L-Lysine) and organic acids (lactic acid and citric acid).</li> </ul>	[5L]
4.2	<ul style="list-style-type: none"> <li>➤ Food microbiology, Fermented foods, Beverages, microbial spoilage of food.</li> <li>➤ Food preservation, microbiology of milk and milk products.</li> </ul>	[3L]
4.3	<ul style="list-style-type: none"> <li>➤ Microbial interactions –Mutualism, commensalism, antagonism and parasitism; Nitrogen fixation, symbiotic and asymbiotic.</li> </ul>	[4L]
4.4	<ul style="list-style-type: none"> <li>➤ Pollution indicator microorganisms, Quantification techniques -MPN and membrane filtration; Role of microorganisms in sewage treatment.</li> </ul>	[3L]

**References:**

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### Mapping of CLOs and PSOs

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Classifies microbe based on morphological characters	X	X				
2	Describes the structure, nutrition and reproduction of bacteria and viruses	X					
3.	Analyze the quality of milk and fermented foods	X	X			X	
4	Explain cultivation and purification of single cell protein.	X	X			X	
5	Develop the employability skills by learning the structure, reproduction and applied aspects of microbes	X	X				X

### Question Paper Template

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

**COURSE TITLE: BIOLOGY AND DIVERSITY OF MICROORGANISMS**

**COURSE CODE: BO-1001**

**[CREDITS - 04]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	8	8			-	-	16
II	6	6	3	3	-	-	18
III	4	4	5	5	-	-	18
IV	4	4	5	5	-	-	18
Total marks per objective	22	22	13	13	-	-	70
% Weightage	31.4%	31.4%	18.6%	18.6%	-	-	100%



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

**Core Course-II**

**COURSE TITLE: ALGAE AND LICHEN**

**COURSE CODE: BO-1002**

**[CREDITS - 04]**

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: <ul style="list-style-type: none"> <li>• Govern the concepts of diversity of algae and lichen.</li> </ul>		
<b>Module 1</b>	<b>Algae-I</b>	<b>[15L]</b>
<b>Learning Objectives:</b> This module is intended to provide: <ul style="list-style-type: none"> <li>• Understanding of the basic structure, cell properties and characters of algae.</li> <li>• Insight to the relation of Algae with Fungi, Lichen and Bryophytes.</li> <li>• Understand its applications for human beings.</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. Elaborate knowledge about algae and will be using to develop skill for identification, importance and applications.</li> </ol>		
1.1	<ul style="list-style-type: none"> <li>➤ Origin, evolution and trends in classification of algae, evolution of chloroplast in algae.</li> <li>➤ Outline of Robert E. Lee (2008) classification of algae.</li> <li>➤ Algal blooms and Toxic algae.</li> </ul>	[6L]
1.2	<ul style="list-style-type: none"> <li>➤ Distinctive characters of major classes:</li> <li>➤ Chlorophyceae, Xanthophyceae, Chrysophyceae, Bacillariophyceae, Cryptophyceae, Dinophyceae, Euglenophyceae, Phaeophyceae, Rhodophyceae, Myxophyceae.</li> </ul>	[9L]
<b>Module 2</b>	<b>Algae II</b>	<b>[15L]</b>
<b>Learning Objectives:</b> This module is intended to provide: <ul style="list-style-type: none"> <li>• The concept of classification criteria for algae and other characters of each class.</li> <li>• Students to understand about the knowledge of different type of culture media and culture of algae.</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. Elaborate knowledge about the collection of algae from land and water.</li> <li>2. Elaborate knowledge about media preparation and culture of specific algae</li> </ol>		



2.1	<ul style="list-style-type: none"> <li>➤ Industrial and biotechnological applications of algae.</li> <li>➤ Cultivation and methods of preservation of algae.</li> <li>➤ Commercial and economic products of sea weeds (Agar, Algin and Carrageenin).</li> </ul>	[8L]
2.2	<ul style="list-style-type: none"> <li>➤ Affinities of algae with Fungi and Bryophytes.</li> <li>➤ Origin and Evolution of sex in Algae.</li> <li>➤ Single cell protein Spirulina.</li> </ul>	[7L]
<b>Module 3</b>	<b>Algae-III</b>	<b>[15L]</b>

**Learning Objectives:**

This module is intended to:

- Students will be able to understand external features and internal peculiarities of algae.
- Students will be able to understand the reproduction and life cycle of Gloeocapsa, Lyngbya, Zygnema, Cladophora, Laminaria, Navicula, Gracillaria.

**Learning Outcome:**

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

1. Enhance detailed knowledge about algal taxa.
2. Identification and application of algae in life.
3. Learn about the morphology, internal structure, reproduction and life cycle of algae.
4. Understand the fundamentals of economic importance a biomedical applications of selected species of algae.

3.1	<ul style="list-style-type: none"> <li>➤ Morphology, cell structure, reproduction and life cycle of following types:  <b>Myxophyceae:</b> Gleocapsa, Lyngbya  <b>Chorophyceae:</b> Zygnema, Cladophora  <b>Rhodophyceae:</b> Polisiphonia, Gracillaria  <b>Phaeophyceae:</b> Sargassum, Laminaria  <b>Bacillariophyceae:</b> Navicula</li> </ul>	[15L]
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<b>Module 4</b>	<b>Lichen</b>	<b>[15L]</b>
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**Learning Objectives:**

This module is intended to:

- Familiarize with this unique biological class.
- General characters, habit and habitat of Lichen, External and internal features of lichen reproduction mode of lichen.
- Types of lichen.
- Ecological Significance and economic importance of lichen.

**Learning Outcome:**

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

1. Elaborate knowledge about industrial and ecological applications.
2. Learn about the morphology, structure, reproduction and life cycle of Lichen.



3. Understand the fundamentals of economic importance a biomedical applications of selected species of lichen.		
4.1	<ul style="list-style-type: none"><li>➤ Introduction of Lichen.</li><li>➤ General characters of Lichen.</li><li>➤ Occurrence of lichen.</li></ul>	[5L]
4.2	<ul style="list-style-type: none"><li>➤ Classification of Lichen.</li><li>➤ Thallus Structure of lichen.</li><li>➤ Reproduction in Lichen.</li><li>➤ Economic and Ecological importance of Lichen.</li></ul>	[6L]
4.3	<ul style="list-style-type: none"><li>➤ <b>Usnea:</b> Classification, Morphology, Internal structure and Reproduction.</li></ul>	[4L]

**References:**

- Bhattia, A.(2004).Treatise on Algae. S. Chand & Company ,New Delhi
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**Question Paper Template**

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

**COURSE TITLE: ALGAE AND LICHEN**

**COURSE CODE: BO-1002**

**[CREDITS - 04]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	8	8	-	-	-	-	16
II	6	6	3	3	-	-	18
III	3	3	6	6	-	-	18
IV	3	3	6	6	-	-	18
Total marks per objective	20	20	15	15	-	-	70
% Weightage	28.6%	28.6%	21.4%	21.4%	-	-	100%

**Mapping of CLOs and PSOs**

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Classifies algae based on morphological characters	X	X				
2	Describes the structure, reproduction of algae	X					
3.	Illustrate the structure and reproduction in lichens	X	X			X	
4	Understand the fundamentals of economic importance and biomedical applications of selected species of Algae and Lichen	X	X			X	
5	Familiarize the use of microscope for identification selected algae and lichen		X			X	



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

**Core Course-III**

**COURSE TITLE: FUNGI AND PLANT PATHOLOGY (1003)**

**COURSE CODE: BO-1003**

**[CREDITS – 04]**

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ul style="list-style-type: none"> <li>• Become self-sustaining by gaining a knowledge of Fungi and plant pathogens.</li> <li>• Start their start-ups and be an entrepreneur.</li> <li>• Prepare products from fungi and utilize in medicine and in other areas.</li> </ul>		
<b>Module 1</b>	<b>Mycology-I</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to:</p> <ul style="list-style-type: none"> <li>• Introduce to scope, importance, uses, and market demand of Fungi.</li> <li>• Understanding Plant diseases, types, and prevention.</li> <li>• Elaborate knowledge about fungi to be used to develop industrial application.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Start their start-ups and be an entrepreneur.</li> <li>2. Prepare products preparation from fungi and utilize them in medicine and in others.</li> </ol>		
1.1	<ul style="list-style-type: none"> <li>➤ Fungi-General characters (Ultra-structure of thallus and reproduction)</li> <li>➤ Unicellular and multicellular organization.</li> <li>➤ Cell wall composition and nutrition.</li> <li>➤ Classification of Fungi (Ainsworth).</li> </ul>	[6L]
1.2	<ul style="list-style-type: none"> <li>➤ Parasexuality in Fungi. (Mechanism of Parasexual cycle and application of Parasexuality).</li> <li>➤ Edible Fungi: Mushroom and their cultivation, Economic importance of Fungi.</li> </ul>	[6L]
1.3	<ul style="list-style-type: none"> <li>➤ Useful activities and Harmful activities of Fungi.</li> <li>➤ Heterothallism.</li> </ul>	[3L]
<b>Module 2</b>	<b>Mycology-II</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to:</p> <ul style="list-style-type: none"> <li>• Help in learning thallus Structure, cell structure, nutrition and life cycle of the Fungi.</li> <li>• Provide Knowledge about nutrition and life cycle of given different fungi in the syllabus.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to:</p>		



<ol style="list-style-type: none"> <li>Identify given fungi in the syllabus.</li> <li>Importance of about serendipity (by chance discovery) and keen observation leading to the discovery of Penicillin.</li> </ol>		
2.1	<ul style="list-style-type: none"> <li>➤ Occurrence, classification, thallus Structure, cell structure, nutrition and life cycle of the following:  <b>Phytophthora</b>  <b>Rhizopus</b>  <b>Penicillium</b>  <b>Claviceps</b>  <b>Ustilago</b>  <b>Colletotrichum</b></li> </ul>	[15L]
<b>Module 3</b>	<b>Plant pathology-I</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b>  This module is intended to:</p> <ul style="list-style-type: none"> <li>• Provide students with the latest information in the field of plant pathology.</li> <li>• Explain the theoretical basis of the tools, technologies and methods commonly used in plant pathology.</li> </ul>		
<p><b>Learning Outcome:</b>  After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Learn history of plant pathology.</li> <li>2. Understand Basics of plant diseases.</li> <li>3. Identify anatomical and morphological symptoms on host.</li> </ol>		
3.1	<ul style="list-style-type: none"> <li>➤ History and scope of plant pathology.</li> <li>➤ Introduction of Plant disease.</li> <li>➤ Pathogenesis (Pre-penetration changes, Penetration process, Post-penetration changes).</li> </ul>	[4L]
3.2	<ul style="list-style-type: none"> <li>➤ General symptoms of plant diseases.</li> <li>➤ Symptoms due to the nature, structure and appearance of visible pathogen.</li> </ul>	[4L]
3.3	<ul style="list-style-type: none"> <li>➤ Anatomical and morphological symptoms on host.</li> <li>➤ Dispersal of plant pathogens.</li> <li>➤ Plants defend themselves against infection.</li> </ul>	[3L]
3.4	<ul style="list-style-type: none"> <li>➤ Classification of plant diseases: On the basis of Infection, Pathogen occurrence, Geographical distribution and Perpetuation of spread.</li> <li>➤ Disease control- Prophylactic measure, curative measures, biological measures.</li> </ul>	[4L]
<b>Module 4</b>	<b>Plant pathology-II</b>	<b>15L</b>
<p><b>Learning Objectives:</b>  This module is intended to</p>		



- Knowledge of plant pathogens.
- Learning value-Plant diseases and prevention.

**Learning Outcome:**

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

1. Learn fungal, bacterial, viral and phytoplasma diseases.

4.1	➤ <b>Fungal diseases of plants:</b> Wheat (Rust, Smut, Bunt), Wilt of cotton	[4L]
4.2	➤ <b>Bacterial diseases of plants:</b> Citrus canker, Bacterial blight of paddy	[4L]
4.3	➤ <b>Viral diseases of plants:</b> TMV, Bhindi (Yellow vein mosaic virus)	[3L]
4.4	➤ <b>Phytoplasma diseases of plants:</b> Little leaf of brinjal	[4L]

**References:**

- Alexopoulos, C. J., Mims, C.W. and Blackwel, M., Introductory Mycology, John Wiley & Sons Inc.
- Mandahar, C.L. Introduction to Plant Viruses. Chand & Co. Ltd., Delhi.
- Mehrotra, R.S. and Aneja, R.S. An introduction to Mycology. New Age Intermediate Press.
- Rangaswamy, G. and Mahadevan, A. 1999. Disease of crop plants in India. Prentice Hall of India Pvt. Ltd., New Delhi.
- Singh R.S. Plant diseases. 6<sup>th</sup> edition. Oxford and IBH, New Delhi.
- H.C. Dubey: An introduction to Fungi. (Fourth edition) Scientific publishers (India).
- Singh, Pandey and Jain. A text book of Botany. Rastogi Publications. Meerut.
- Practical Botany Vol-1 and 2 by B.P. Pandey.
- Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).



### Mapping of CLOs and PSOs

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Identify important fungi forms by their morphological and anatomical features	X	X				
2	Describe the morphology and reproduction of the various genera of fungi.	X					
3.	Understanding of fungicide and use of chemical physical and biological controlling of diseases mentioned in the unit.	X	X			X	
4	Illustrate the disease cycle of bacterial, viral and fungal pathogens of plants.	X	X			X	
5	Develop the employability skills by learning the controlling of diseases managements of plant pathogen.	X	X				X



## Question Paper Template

M.Sc. (BOTANY) SEMESTER I

COURSE TITLE: FUNGI AND PLANT PATHOLOGY

COURSE CODE: **BO-1003**

[CREDITS - 04]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	8	8					16
II	6	6	3	3			18
III	4	4	5	5			18
IV	4	4	5	5			18
Total marks per objective	22	22	13	13			70
% Weightage	31.4%	31.4%	18.6%	18.6%			100%



**M. Sc. (Botany) SEMESTER I**

**ELECTIVE PAPER-I**

**COURSE TITLE: ORGANIC FARMING AND AGRONOMY (1004)**

**COURSE CODE: BO-EL-1004**

**[CREDITS - 04]**

Course Learning Outcome		
<p>After the successful completion of the course, the learner will be able to:</p> <ul style="list-style-type: none"> <li>• Create awareness about organic farming.</li> <li>• Equip learners with the knowledge and skills necessary to practice sustainable agriculture and the production of healthy, organic food.</li> <li>• Understand the concept of organic ecosystem and learn about biological magnification and its significance in present day scenario.</li> </ul>		
<b>Module 1</b>	<b>Introduction of organic farming</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to:</p> <ul style="list-style-type: none"> <li>• Describe history and development of organic farming.</li> <li>• Explain different methods, advantage and limitation of organic farming.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Need of organic farming.</li> <li>2. Describe land preparation and practice of organic farming.</li> <li>3. Composting, biogas and agro waste management.</li> </ol>		
1.1	<ul style="list-style-type: none"> <li>➤ History and development of organic farming.</li> <li>➤ Definition and principle of organic farming.</li> </ul>	[3L]
1.2	<ul style="list-style-type: none"> <li>➤ Land preparation- tools and technique for organic farming. Preparation of seed bed, manuring, sowing, watering and raising of seedling.</li> </ul>	[4L]
1.3	<ul style="list-style-type: none"> <li>➤ Methods (Crop rotation, Green manure, Compost, Crop diversity, Soil Management, Controlling pests Biologically, Weed Management utilization, Livestock), Advantage and limitation of organic farming.</li> </ul>	[4L]
1.4	<ul style="list-style-type: none"> <li>➤ Need of organic farming in present context and future prospects-barrier.</li> <li>➤ Conventional farming v/s organic farming.</li> </ul>	[4L]
<b>Module 2</b>	<b>Soil</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to:</p> <ul style="list-style-type: none"> <li>• Explain C and N ratio in fertility of soil.</li> <li>• Role of soil in organic farming.</li> </ul>		



<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Role of soil in organic farming.</li> <li>2. Abiotic factor affecting on plant growth.</li> </ol>		
2.1	<ul style="list-style-type: none"> <li>➤ Definition, Composition of Soil- Soil texture and types, Soil structure, Soil Profile, Humus and Soil pH.</li> <li>➤ Role of soil in organic farming.</li> <li>➤ Land preparation and mulching.</li> </ul>	[8L]
2.2	<ul style="list-style-type: none"> <li>➤ Abiotic factor affecting on plant growth: light, heat, water, humidity, pH and nutrition.</li> <li>➤ C, N ratio of good fertile soil.</li> </ul>	[7L]
<b>Module 3</b>	<b>Plant nutrient</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to:</p> <ul style="list-style-type: none"> <li>• Explain Micro and Macro plant nutrient in organic farming.</li> <li>• Describe method of composting in organic farming.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Learn about bulky organic manures and bio-fertilizers.</li> </ol>		
3.1	<ul style="list-style-type: none"> <li>• Plant nutrient- Micro and Macro, Importance and deficiency symptoms.</li> <li>• Sources: Organic, Green manure- Method of composting, Benefit and limitation.</li> <li>• Bulky organic manures, concentrated organic manures.</li> <li>• Bio-fertilizers- types, methods of application, advantages and disadvantages.</li> <li>• Soil microorganism: Significance of Mycorrhiza, Rhizosphere.</li> </ul>	[15L]
<b>Module 4</b>	<b>Crop management, certification and marketing</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to:</p> <ul style="list-style-type: none"> <li>• Explain different types of pest control in organic farming.</li> <li>• Describe crop rotation in organic farming.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Harvesting and post harvesting management of organic farming.</li> </ol>		



4.1	<ul style="list-style-type: none"> <li>➤ Pest control: Cultural, Biological and Mechanical method</li> <li>➤ Integrated pest management.</li> <li>➤ Crop rotation: need and benefits.</li> <li>➤ Harvesting and Post Harvesting Management.</li> </ul>	[8L]
4.2	<ul style="list-style-type: none"> <li>➤ Inspection, Certification and Labelling procedure</li> <li>➤ Marketing and Export</li> </ul>	[7L]

**References:**

- **Palaniappan SP &Anandurai K. 1999**, Organic Farming-Theory and Practice.
- **Joshi, M. 2014**. New Vistas of Organic Farming 2nd Ed. Scientific Publishers.
- Farming system: Theory and Practice - **S.A.Solaimalai**
- Organic Farming: Theory and Practice-**S.P.Palaniappan and K.A. Annadurai**
- A hand book of Organic Farming **by A.K.Sharma**

**Mapping of CLOs and PSOs**

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Understand Role of soil in Organic farming.	X	X				
2	Realize various weed management practices.	X					
3.	Illustrate the Integrated Pest Management	X	X			X	
4	Understand the use organic manures and Bio-fertilizers for organic farming	X	X			X	
5	Familiarize with various tool and technique use in agronomy		X			X	



## Question Paper Template

M.Sc. (BOTANY) SEMESTER I

COURSE TITLE: ORGANIC FARMING AND AGRONOMY

COURSE CODE: **BO-EL-1004**

[CREDITS - 04]

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	6	6	4	4	-	-	20
II	6	6	3	3	-	-	18
III	3	3	5	5	-	-	16
IV	3	3	5	5			16
Total marks per objective	18	18	17	17			70
% Weightage	25.7%	25.7%	24.3%	24.3%			100%



## M. Sc. (BOTANY) SEMESTER I

### Skill based Course-I

#### COURSE TITLE: (1) MUSHROOM CULTIVATION

COURSE CODE: **BO-SKL-1005**

[CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be prompted in:</p> <ul style="list-style-type: none"> <li>• Having an insight in to the world of mushrooms, the unique group of plants.</li> <li>• Differentiate between poisonous and edible mushrooms</li> <li>• Wild Mushrooms of India yet waiting to be introduced to the world (Lycoperdon, Dictyophora)</li> <li>• Learning, cultivation, and harvesting of different edible and medicinal mushrooms.</li> <li>• Can becoming self-sustaining thorough knowledge of edible mushrooms and their cultivation.</li> <li>• Resuming their start-ups and be an entrepreneur.</li> <li>• Developing products from mushrooms and utilize spent mushroom substrate in farming, composting, and in other possible uses.</li> </ul>		
<b>Module 1</b>	<b>Introduction, Types, and Requirements</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to:</p> <ul style="list-style-type: none"> <li>• To scope, importance, use, and market demand of mushrooms.</li> <li>• Understand mushrooms, types, and mushroom production.</li> <li>• Introduce climatic requirements, compost, disease, and pest control of mushroom cultivation.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the prospects of cultivation of different types of edible mushrooms.</li> <li>2. Identify climatic requirements, composting requirements, and methods of harvesting of mushroom cultivation.</li> </ol>		
1.1	<ul style="list-style-type: none"> <li>➤ Introduction to mushroom, Internal Structure of mushroom.</li> <li>➤ History of Mushroom Cultivation. Nutritional value of mushroom, Scope &amp; importance of Mushroom cultivation in <b>India</b>.</li> </ul>	[4L]
1.2	<ul style="list-style-type: none"> <li>➤ Fundamentals of cultivation system- small village unit &amp; larger commercial unit.</li> <li>➤ Principles of mushroom farm layout- location of building plot, design of farm, bulk chamber, composting platform, types of equipment &amp; facilities, pasteurization room &amp; growing rooms.</li> </ul>	[5L]



1.3	<ul style="list-style-type: none"> <li>➤ Different types of compost for cultivation- natural &amp; synthetic.</li> <li>➤ Principles of composting.</li> <li>➤ Methods of Composting- Long method of composting (LMC) &amp; Short method of composting (SMC).</li> <li>➤ Pasteurize the compost to kill insects, nematodes, pest fungi, or other pests.</li> </ul>	[4L]
1.4	Disease control, pest management activity, and mites control method.	[2L]
<b>Module 2</b>	<b>Cultivation and harvesting</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to</p> <ul style="list-style-type: none"> <li>• Learning about commercially important types of mushrooms.</li> <li>• Knowledge about Types of spawn, Propagation method, Spawning Method, and Development stages of mushrooms.</li> <li>• Knowledge of harvesting and post-harvesting processes, and packaging of mushrooms.</li> <li>• Learning value-added product preparation from mushrooms.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to:</p> <ul style="list-style-type: none"> <li>• Identify Spawn types, Spawn stage of mushroom cultivation.</li> <li>• Able to used different type of cultivation method for mushroom cultivation.</li> <li>• Able to use different types of cultivation and harvesting methods for mushroom cultivation.</li> <li>• Prepare value-added products out of mushroom and utilize spent mushroom substrate in composting and in other uses.</li> </ul>		
2.1	<ul style="list-style-type: none"> <li>➤ Select commercially important type of mushroom, growing season and investments in mushroom cultivation. Oyster, Button Ganoderma, Flammulina, Auricularia,,Milky</li> </ul>	[3L]
2.2	<ul style="list-style-type: none"> <li>➤ Types of spawn, Spawn Propagation method, Spawning method/ Methods of spawn preparation.</li> <li>➤ Development stages of mushroom.</li> </ul>	[2L]
2.3	<ul style="list-style-type: none"> <li>➤ Cut, clean, and dry harvested procedures. Sort and grade the harvests as per required quality specifications.</li> <li>➤ Store, pack, label, and transport produce. Record information: quality, quantity, type, expenditure</li> </ul>	[5L]



	incurred in operation, etc. in appropriate registers, record book, and logs.	
2.4	<ul style="list-style-type: none"> <li>➤ <b>Preparation of value-added products of Mushroom:</b> Pickle, Powder, Papad, and different food items. Recipes to promote mushroom uses.</li> <li>➤ Utilize spent mushroom substrate in organic farming, vermicomposting, bioremediation of contaminated soil, etc.</li> </ul>	[4L]

**References:**

- Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).
- A handbook of edible mushrooms, S.Kannaiyan & K. Ramasamy (1980). Today & Tomorrow's printers & publishers, New Delhi.
- Manual for Mushroom Cultivation by Chenjerayi Kashangura (2004).
- Mushroom Cultivation in India, Daya Publishing House by BC Suman and VP Verma (2007).
- Textbook of Horticulture, Macmillan India Limited by K. Manibhusan Rao (2005)

**Mapping of CLOs and PSOs**

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Understand the Diseases. morphology and types of Mushrooms Post harvesting techniques of Mushrooms.	X	X				
2	Learned the prospects and scope of mushroom cultivation in small scale industry	X					
3.	Deals with soil science and fertility management for horticultural crops.	X	X			X	
4	Students will be able produce spawn on their own					X	X
5	start small scale industry of Mushroom cultivation						X



## Question Paper Template

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

**COURSE TITLE: (1) MASHROOM CULTIVATION**

**COURSE CODE: BO SKL--1005**

**[CREDITS - 02]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	6	6	2	2	-	-	16
II	5	5	2	2	-	-	14
Total marks per objective	11	11	04	04	-	-	30
% Weightage	36.7%	36.7%	13.3%	13.3%	-	-	100%



**M. Sc. (BOTANY) SEMESTER I**  
**Skill based Course-I**  
**COURSE TITLE: (2) DRY LAND HORTICULTURE**

**COURSE CODE: BO-SKL-1005**

**[CREDITS - 02]**

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: <ul style="list-style-type: none"> <li>● Learn about importance, history.</li> <li>● Learn about branches of horticulture.</li> <li>● Learn propagation methods and cultivation of some important crops.</li> <li>● Learn cultivation of important crop in arid region.</li> </ul>		
<b>Module 1</b>	<b>Introduction of dry land horticulture</b>	<b>[15L]</b>
<b>Learning Objectives:</b> This module is intended to <ul style="list-style-type: none"> <li>● Studying the importance Horticulture</li> <li>● Studying the basic concept of Horticulture.</li> <li>● Studying the different branches of horticulture</li> <li>● Studying the cultivation of dry land crops.</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 the basic concepts of dry land horticulture and its prospects.</li> <li>2. Acquire skills in relation to management of soil and water in dry land farming.</li> </ol>		
1.1	➤ History of Horticulture.	[2L]
1.2	➤ Definition, importance and limitation of dry land horticulture. ➤ Present status and future scope. Constraints encounter in dry lands.	[10L]
1.2	➤ Agro-climatic features in rain shadow areas, scares water resources, high temperature, soil erosion, run-off losses etc.	[3L]
<b>Module 2</b>	<b>Soil and water management</b>	<b>[15L]</b>
<b>Learning Objectives:</b> This module is intended to <ul style="list-style-type: none"> <li>● Demonstrate skills on various methods to check the water loss during farming.</li> <li>● Understand the cultivation practices of certain crops suitable for dry land farming</li> </ul>		



**Learning Outcome:**

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

1. Acquire skills in relation to management of soil and water in dryland farming.

2.1	<ul style="list-style-type: none"> <li>➤ <b>Techniques and management of dry land horticulture:</b> watershed development, soil and water conservation methods-terraces, contour bunds.</li> <li>➤ Methods of reducing evapotranspiration, use of shelter belts, mulches anti transparent and growth regulators.</li> </ul>	[5L]
2.2	<ul style="list-style-type: none"> <li>➤ Methods of control and impounding of run-off water-farm ponds, trenches and macro catch pits, etc.</li> <li>➤ In-situ water harvesting methods, micro catchment and different types of tree basins.</li> </ul>	[5L]
2.3	<ul style="list-style-type: none"> <li>➤ Characters, special adaptation and cultivation practices of following horticultural crops: (a) Ber (b) Pomegranate (c) Fig (d) Wood apple (e) Mulberry (f) Falsa (g) Jambu</li> </ul>	[5L]

**References:**

- Chadha, K. L. (ICAR) 2002, 2001. Hand book of Horticulture. ICAR, New Delhi
- Chundawat, B.S. 1990. Arid Fruit Culture. Oxford and IBH, New Delhi.
- P.L. Taroj, B.B. Vashishtha, D.G. Dhandar. 2004. Advances in Arid Horticulture. Internal Book Distributing Co., Lucknow.
- T. Pradeep Kumar, B. Suma, Jyothi Bhaskarand K.N.Sathesan. 2008. Management of Horticultural Crops. New India Publishing Agency



## Question Paper Template

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

#### COURSE TITLE: 2. DRY LAND HORTICULTURE

COURSE CODE: **BO SKL--1005**

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	6	6	2	2	-	-	16
II	5	5	2	2	-	-	14
Total marks per objective	11	11	04	04	-	-	30
% Weightage	36.7%	36.7%	13.3%	13.3%	-	-	100%

#### Mapping of CLOs and PSOs

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Understood the scope and importance of horticulture	X	X				
2	Aare with the mechanism of Pest and Disease Management of Horticultural Crops	X					
3.	Apply horticultural principles to the successful growth and production of horticultural plants..	X	X			X	
4	Communicate effectively within the discipline and also be able to transmit knowledge and skills to lay-persons in the general public.					X	X
5	Synthesize and integrate information to solve horticultural problem						X



## M.Sc. (BOTANY) SEMESTER I

(Practical)

**COURSE TITLE: Practical based on Core paper I to III**

**COURSE CODE: BOP- 1006**

**[Credit- 06]**

### 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 different diversity of plants.

**Module: 1**

**Biology and diversity of Microorganisms**

**[60 Hrs]**

1	Basic microbiological techniques: preparation of media, sterilization, slant and stab preparation. Pouring of plates and pure culture by streak and pour plate method.
2	Preparation of non-selective and selective media; enumeration of bacteria, fungi [plate count] from soil and water.
3	Isolation of pathogenic microorganisms from infected plant tissue.
4	Observation of motility of bacteria [hanging drop technique].
5	Staining methods: Preparation of smears for stains, simple staining, negative staining and gram staining.
6	Spoilage of milk by micro-organisms [Methylene blue test].
7	Micrometry for the Bacterial slide.
8	Direct examination of root nodule bacteria under microscope.
9	Study of Viruses by chart or specimen- Potato Virus, Tomato yellow leaf Curl virus, Ralstonia Phage Virus.
10	To study zone & inhibition test (Kirby-Bauer) for antimicrobial activity.
11	Isolation of N <sub>2</sub> fixing Bacteria <i>Rhizobium</i> .
12	Isolation of N <sub>2</sub> fixing Bacteria <i>Azotobacter</i> .
13	Isolation and identification of bacteria in soil.



Module: 2		Algae and Lichen	[60 Hrs.]
1	To study algae <i>Lyngbya</i> . (Permanent Slide of Lyngbya).		
2	To study algae <i>Scytonema</i> . (Permanent Slide of Scytonema).		
3	To study algae <i>Gleocapsa</i> . (Permanent Slide of Gleocapsa).		
4	To study algae <i>Anabaena</i> . (Permanent Slide of Anabaena).		
5	To study algae <i>Pandorina</i> . (Permanent Slide of Pandorina).		
6	To study algae <i>Cladophora</i> . (Permanent Slide of Cladophora)		
7	To study algae <i>Pediastrum</i> . (Permanent Slide of Pediastrum)		
8	To study algae <i>Laminaria</i> . (Permanent Slide of Laminaria)		
9	To study algae <i>Pithophora</i> . (Permanent Slide of Pithophora )		
10	To study algae <i>Zygnema</i> . (Permanent Slide of Zygnema,).		
11	To study algae <i>Nitella</i> . (Permanent Slide of Nitella).		
12	To study algae <i>Fucus</i> . (Permanent Slide of fucus).		
13	To study algae <i>Gracilaria</i> . (Permanent Slide of cystocarp).		
14	To study lichen <i>Usnea</i> . (Permanent Slide of Usnea).		
15	Student should collect and identify common field Algae and prepare a field report of collection activities in the journal itself.		
16	Isolation of algae from soil.		
Module: 3		Fungi and Plant Pathology	[60 Hrs.]
1	To study fungi <i>Phytophthora</i> (Permanent Slide: t.s. of infected leaf showing sporangia: Specimen: Irish blight of potato, blight of Colocasia)		
2	To study fungi <i>Rhizopus</i> . (Permanent Slide: Sporangia, zygospore)		
3	To study fungi <i>Penicillium</i> (Permanent Slide: Mycelium bearing conidia, Ascocarp)		
4	To study fungi <i>Claviceps</i> . (Permanent Slide: Mycelium showing conidiophores, V.S. of stroma, V.S. of ascocarp)		
5	To study fungi <i>Ustilago</i> . (Permanent Slide: Chlamydo spores (Teleutospores), Specimen (any one: covered smut of barley or oat, Loose smut of wheat, common smut of maize)		
6	To study fungi <i>Colletotrichum</i> . (Permanent Slide: inter and intracellular mycelium, Acervulus and conidia, Specimen: Red rot of sugarcane – lesions on stem and leaf)		



7	Isolation and identification of fungi from soil.
8	Causal organism, symptoms and control measures of the following plant diseases. <ul style="list-style-type: none"><li>➤ Fungal diseases of plants: Wheat(Rust, Smut, Bunt), Wilt of cotton</li><li>➤ Bacterial diseases of plants: Citrus canker, Bacterial blight of paddy</li><li>➤ Viral diseases of plants: TMV, Bhindi (Yellow vein mosaic virus)</li><li>➤ Phytoplasma diseases of plants: Little leaf of brinjal</li></ul>

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