

# **VIVEKANANDHA**

## **COLLEGE OF ARTS AND SCIENCES FOR WOMEN**

### **(AUTONOMOUS)**

**ELAYAMPALAYAM, THIRUCHENGODE (Tk), NAMAKKAL (Dt) - 637 205**  
(Affiliated to Periyar University, Approved by AICTE and Re-Accredited with “A<sup>+</sup>” by NAAC)



## **PG AND RESEARCH DEPARTMENT OF BOTANY**

### **B. Sc., BOTANY**

### **SYLLABUS**

(For the candidates admitted from the year 2023-2024 onwards)

(TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005)

**VIVEKANANDHA EDUCATIONAL INSTITUTIONS**

**ANGAMMAL EDUCATIONAL TRUST**

**ELAYAMPALAYAM, THIRUCHENGODE (Tk), NAMAKKAL (Dt) - 637 205**

**VIVEKANANDHA**  
**COLLEGE OF ARTS AND SCIENCES FOR WOMEN**  
(AUTONOMOUS)  
ELAYAMPALAYAM, TIRUCHENGODE  
Affiliated to Periyar University, Approved by AICTE and Re-Accredited with “A<sup>+</sup>” by NAAC  
**B.Sc., Botany**

**For Candidates Admitted from the academic year - 2020 – 2021 Onwards Under Tamil Nadu State Council for Higher Education Syllabus Pattern:**

**1. Vision:** To imparting skills and values for the women graduates through innovative teaching, learning and research in plant science to meet the needs of youth and national demand.

**2. Mission:**

1. To create demand for Botany.
2. Strengthen the Department by research.
3. To provide quality education through field study and projects, laboratory courses and entrepreneurial skills in Botany to achieve their diligence.
4. To raise the students high academic caliber to meet the requirements of industries through productive research in various fields of Botany.
5. To enhance opportunities to the rural women students for their successful career.

**3. Scope of the programme:**

Botany is a classical science dealing with not merely the morphology of plants but also their functional aspects and economic importance. Further, the study helps us to understand the role of plants in maintaining the environment besides, saving as a renewable energy sources. Plants are most valuable in treating the ailments of mankind. It has several branches such as Plant Diversity, Plant Morphology, Taxonomy, Anatomy, Embryology, Plant Pathology, Plant Ecology, Ethnobotany, Genetics, Plant Biotechnology, Plant Physiology, Biochemistry, Horticulture, Medicinal Plants, Biofertilizers, etc., besides serving as the basis for several other biosciences. It is a basic science with several research disciplines like modern transgenic biology.

**4. Programme Outcomes (POs):**

The B.Sc. Botany program is designed to achieve the following objectives

PO1	Apply the knowledge of science and technology fundamentals for findings solution for complex problems.
PO2	To provide up to date theoretical knowledge on various forms of plants, their interactions with biotic and abiotic entities in the ecosystem and relevant practical skills.
PO3	To comprehend and interpret various facets of Botany including the importance and judicious utilization of plant sources.

PO4	Exploration of diverse plant life-forms and to nature the conservation of biodiversity.
PO5	To understand the principles and applications of various traditional and modern techniques used in Botany.
PO6	To disseminate knowledge on the design and execution of experiments in Botany with emphasis on the operation of relevant sophisticated instruments.
PO7	To impart knowledge on the economic importance of plant/microbial resources and their products and to promote entrepreneurship skill.
PO8	To promote proficiency in designing the research problems, review of literature, laboratory experiments, data analyses and preparation of reports with professional ethics.
PO9	To motivate the students to take up innovative and cutting-edge research in frontier areas of Botany and related biology subjects.
PO10	To enable the students to take up various qualifying examinations concerning Botany and to face the challenges in career opportunities.

### 5. Programme Specific Outcomes (PSOs):

On successful completion of the B.Sc. Botany program, the students are expected to

PSO1	Implement the concept of science and technology to foster the traditional and modern techniques for solving the complex problems in Plant Biology.
PSO2	Ensure the use of contemporary tools and techniques in understanding the scope and significance of Botany
PSO3	Develop the scientific problem solving skills during experimentation, research projects, analysis and interpretation of data
PSO4	Design scientific experiments independently and to generate useful information to address various issues in Botany.
PSO5	Enhanced capacity to think critically; ability to design and execute experiments independently and/or team under multidisciplinary settings
PSO6	Design and standardize protocols for public health and safety, and cultural, societal, and environmental considerations
PSO7	Apply appropriate techniques, resources, and modern ICT tools for understanding plant resources.
PSO8	Demonstrate the contextual knowledge in sustainable exploitation of medicinal, economically important and endangered plants as per the National Biodiversity Act.

PSO9	Follow the concept of professional ethics and bioethics norms for practicing the value of plant kingdom.
PSO10	Communicate proficiently with various stakeholders and society, to comprehend and to write and present reports effectively

#### 6. Methods of Evaluation:

<b>Theory</b>		
<b>Internal Evaluation</b>	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
<b>External Evaluation</b>	End Semester Examination	75 Marks
<b>Total</b>		<b>100 Marks</b>
<b>Practicals</b>		
<b>Internal Evaluation</b>	Continuous Internal Assessment Test	40 Marks
	Attendance and Class Participation	
<b>External Evaluation</b>	End Semester Examination	60 Marks
	Record	
<b>Total</b>		<b>100 Marks</b>
<b>Methods of Assessment</b>		
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions.	
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, Short summary or overview.	
<b>Application (K3)</b>	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain.	
<b>Analyze (K4)</b>	Problem-solving questions Finish a procedure in many steps, Differentiate between various ideas, Map knowledge.	
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons.	
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations.	

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the Course outcomes. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your Course outcomes.**

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

## 7. Scheme of Examination:

The scheme of Examinations for different semesters shall be as follows

**B.Sc., Botany**  
(For the candidates admitted from the academic year 2023 - 2024 onwards)  
(Tamil Nadu State Council for Higher Education)

Semester	Course	Course Title	Subject Code	Ins. Hours/ Week	Credits	Exam Hours	Marks		Total
							Int.	ESE	
I	Part – I	Language – Tamil - I	23U1LT01	6	3	3	25	75	100
	Part - II - English	English - I	23U1LE01	*4	3	3	25	75	100
	Part – III Core Course - I	Plant Diversity I – Algae	23U1BOC01	5 (4+1)	4	3	25	75	100
	Core Course - II	Plant Diversity I - Algae – Practical - I	23U1BOCP01	4 (3+1)	3	3	40	60	100
	Part - III – Allied Paper - I	Allied Zoology r – I	23U1ZOGEO1	4 (3+1)	2	3	25	75	100
	Part - III - Allied Practical – I	Allied Zoology Practical – I	23U1ZOGEP01	2	2	3	40	60	100
	Part - IV Skill Enhancement Courses SEC – I - NME - I	Organic farming	23U1BOS01	2	1	3	25	75	100
	Foundation Course FC	Basics of Botany	23U1BOFC01	1	1	3	25	75	100
	AECC - Ability Enhancement Compulsory Course	Soft Skill - I	23U1BOAC01	2	2	3	25	75	100
	<b>Total</b>				<b>30</b>	<b>21</b>	<b>-</b>	<b>255</b>	<b>645</b>
<b>Remarks: Soft Skill I - 2 hours handled by English staff - Totally - 4+2= 6</b>									
II	Part – I	Language – Tamil - II	23U2LT02	6	3	3	25	75	100
	Part - II - English	English - II	23U2LE02	*4	3	3	25	75	100
	Part - III Core Course - III	Plant Diversity II – Fungi, Bacteria, Viruses, Plant pathology and Lichens	23U2BOC02	4 (3+1)	4	3	25	75	100
	<b>Core Course - IV</b>	Plant Diversity II - Fungi, Bacteria, Viruses, pathology and Lichens – Practical - II	23U2BOCP02	4 (3+1)	3	3	40	60	100
	Part - III - Allied Paper – II	Allied: Zoology Paper – II	23U2ZOGEO2	4 (3+1)	2	3	25	75	100
	Part - III - Allied Practical – II	Allied Zoology Practical - II	23U2ZOGEP02	2	2	3	40	60	100
	Part – IV Skill Enhancement Course SEC 2 – NME - II	Mushroom cultivation	23U2BOS02	2	1	3	25	75	100
	Ability Enhancement Compulsory Course AECC	Soft Skill 2	23U2BOAC02	2	1	3	25	75	100
	Value Education	Environmental Studies	23U2EVS02	2	2	3	25	75	100
	<b>Total</b>				<b>30</b>	<b>21</b>	<b>-</b>	<b>255</b>	<b>645</b>
<b>Remarks: Soft Skill II - 2 hours handled by English staff; Totally 4+2= 6</b>									

## **8. Conditions for Admission:**

A candidate who has passed Higher Secondary Examination in academic or vocational stream with Botany under Higher Secondary Board of Examinations, Tamil Nadu or an examination accepted as equivalent there to or as per norms said by the Government of Tamil Nadu are permitted to appear and qualify for B. Sc., Degree examination of this university after a course of study of three academic years.

## **9. Duration of the Programme:**

The programme for the degree of Bachelor of Science in Botany shall consist of three academic years divided into six semesters.

## **10. Examination:**

The theory and practical examination shall be of three hours duration to each paper at the end of the semester. The candidates failed in any subject will be permitted to appear for each failed subject or subjects in the subsequent examination. However in the final semester examination if the failure one or two subjects they can appear for a supplementary exam within a month.

The examination consists of Continuous Internal Assessment (CIA) and External Assessment (EA).

### **Internal Assessment Marks for Theory papers are as follows**

Attendance	- 5 Marks
Assignment	- 5 Marks
CIA – I and II Test	- 5 Marks
Model Examinations	- <u>10 Marks</u>
<b>Total</b>	- <u>25 Marks</u>

### **Internal Assessment Marks for Theory papers are as follows**

Attendance	- 10 Marks
Observation Note	- 10 Marks
Model Examinations	- <u>20 Marks</u>
<b>Total</b>	- <u>40 Marks</u>

## 11. Distribution of Marks for Attendance:

Percentage	Marks	
	Theory	Practical
75 - 80	1	2
81 - 85	2	4
86 - 90	3	6
91 - 95	4	8
96 - 100	5	10

### Note:

Minimum 75 % of attendance is compulsory to sit for the exam. A Condonation can be permitted between 65 % and 74.9 %.

### Question Paper Pattern for B. Sc., Botany Programme

**Time: 3 Hrs**

**Max. Marks: 75**

**PART – A** (10 x 1 = 10 Marks)

*(Answer all questions)*

(Multiple Choice Questions - Four questions from each unit)

**PART – B** (5 x 7 = 35 Marks)

*(Answer all questions)*

(One question from each unit with internal choice)

**PART – C** (3 x 10 = 30 Marks)

*(Answer any three questions)*

(One question from each unit)

## 12. Format to be followed in dissertation

The formats/certificate for dissertation to be submitted by the students are given below:

### 1) Format for the preparation of project work

- (a) Title page
- (b) Bonafide certificate
- (c) Acknowledgement
- (d) Table of contents

## **Contents**

Chapter No.	Title	Page No.
1.	Introduction	
2.	Review of literature	
3.	Materials and Methods	
4.	Results	
5.	Discussion	
6.	Summary	
7.	References	

### Format of the title Page

#### **TITLE OF THE DISSERTATION**

Dissertation Submitted in partial fulfillment of the  
requirement for the award of the Degree of

#### **Bachelor of Science in Botany**

to the Periyar University, Salem 636 011

By

Student Name

Register Number

Under the Guidance of

Guide Name

College / University Department

Year



## **Format of the Certificate**

### **CERTIFICATE**

This is to certify that the dissertation entitled .....(title of the dissertation).....submitted by ..... (name of the candidate).... in partial fulfillment of the requirement of the degree of Master of Science in Botany to the Periyar University, Salem is a bonafide record of independent research work done by her during the period .... (Year)... of her study in the Department of Botany at Vivekanandha College of Arts and Sciences for Women, Elayampalayam, under my supervision and guidance. This dissertation has not formed the basis for the award of any Degree, Diploma, similar titles or associate ship to any candidates of this University.

Viva –Voce Examination Date:

**Signature of Head**

**Signature of the Guide**

**Examiners: 1.**

**2.**

### **13. Passing Minimum:**

The Candidate shall be declared to have passed the examination if the candidate secures not less than 30 marks out of 75 marks in each theory paper. There is no passing minimum for internal assessment. For the practical paper, a minimum of 24 marks out of 60 marks in the practical examination and the record notebook taken together. There is no passing minimum for internal assessment and record note book. However submission of a record note book is a must. For the project work and viva – voce the candidate should secure 24 marks out of 60 marks for pass. There is no passing minimum for internal assessment. The candidate should compulsorily attend viva-voce examination to secure pass in that paper. Candidate who does not obtain the required minimum marks for a pass in a paper/project report shall be required to appear and pass the same at a subsequent appearance.

#### **14. Classification of successful candidates:**

Candidates who secure not less than **60%** of the aggregate marks in the whole examination shall be declared to have passed the examination in **first class**. All other successful candidates shall be declared to have passed in the **second class**.

Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in **first class with distinction** provided they pass all the examinations prescribed for the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of three academic years from the year of admission to the course only are eligible for **Autonomous Ranking**.

#### **15. Maximum duration for the completion of the B. Sc., Botany Programme:**

The maximum duration for completion of the UG Programme shall not exceed 6 semesters.

#### **16. Commencement of this Regulation**

These regulations shall take effect from the academic year 2023-24, i e., for students who are to be admitted to the first year of the course during the academic year 2023-24 and thereafter.

#### **17. Transitory Provision**

Candidates who were admitted to the B. Sc., Botany programme of study before 2023-24 shall be permitted to appear for the examinations under those regulations for a period of three years i.e., up to and inclusive of the examination of April/May 2023. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

**Core – I – Plant Diversity –I - Algae**

<b>Title of the Course</b>		<b>Plant Diversity – I - Algae</b>					
<b>Paper Number</b>		<b>Core - I</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>4</b>	<b>Course Code</b>	<b>23U1BOC01</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		<b>3</b>	<b>2</b>	<b>-</b>	<b>5</b>		
<b>Pre-requisite</b>		Students should be familiar with the basics of different classes of algae.					
<b>Learning Objectives:</b>							
<b>C1</b>	To provide a comprehensive knowledge on the biology of algae.						
<b>C2</b>	To provide a basis for better understanding of the evolution higher of plants.						
<b>C3</b>	To understand reproductive biology, ecology of plants by studying the simpler systems in algae.						
<b>C4</b>	To understand the role of algae in ecosystems as primary producers of nutrition.						
<b>C5</b>	To understand importance of algae to animals and humans.						
<b>Course Outcomes</b>	<b>On completion of this course, students will be able to:</b>						
<b>CO1</b>	Relate to the structural organization, reproduction and significance of algae.					<b>K1</b>	
<b>CO2</b>	Demonstrate knowledge in understanding the various life cycle patterns and the fundamental concepts in algal growth					<b>K2</b>	
<b>CO3</b>	Explain the benefits of various algal technologies on the ecosystem.					<b>K3</b>	
<b>CO4</b>	Compare and contrast the thallus organization and modes of reproduction in algae.					<b>K4</b>	
<b>CO5</b>	Determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.					<b>K5</b>	
<b>Unit</b>	<b>Contents</b>						
<b>I</b>	Classification (Fritsch-1935-1945), criteria for classification and algal distribution.						
<b>II</b>	Thallus organization (unicellular- <i>Chlorella</i> , Diatoms, colonial- <i>Volvox</i> , filamentous- <i>Anabaena</i> , <i>Oedogonium</i> , siphonous- <i>Caulerpa</i> , parenchymatous- <i>Sargassum</i> and <i>Gracilaria</i> ).						
<b>III</b>	Reproduction - Vegetative, asexual, sexual reproduction and life histories (haplontic-, <i>Oedogonium</i> and <i>Chara</i> , diplontic - Diatoms and <i>Sargassum</i> , diplohaplontic - <i>Ulva</i> and diplobiontic - <i>Gracilaria</i> )						
<b>IV</b>	Algal cultivation methods, Algal production systems; indoor cultivation methods and large-scale cultivation of algae and harvesting of algae.						

V	Algae as food and feed: Agar-agar, Alginic acid and Carrageenin; Diatomite. Resource potential of algae: Application of algae as fuel, agriculture and pharmaceutical. Phycoremediation. Role of algae in CO <sub>2</sub> sequestration, Algae as indicator of water pollution, algal bioinoculants and Bioluminescence.
Extended Professional Component (is a part of internal component) only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Texts:</b>	
1	Dehradun. Edwardlee, R. 2018. Phycology, 5 <sup>th</sup> Ed., Cambridge University Press, London.
2	Kumar, H. D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi
3	Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.
4	Vashishta, P.C. 2014. S. Chand & Company Ltd, New Delhi.
5	Ian Morris. 1977. An introduction to the algae. Hutchinson & Co (Publishers) Ltd. London.
<b>References Books:</b>	
1	Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani. ISBN: 978-9922-20-391-1.
2	Mihir Kumar, D. 2010. Algal Biotechnology. Daya Publishing House, New Delhi.
3	Chapman V.J. and Chapman D.J, 2013. The Algae. Alpha Numera.
4	Fritsch, F.E. 1945. Structure and reproduction of Algae. Cambridge University press.
5	Round, FE. 1984. The Ecology of Algae. Cambridge University Press.
6	Lee, R.D. 2008. Phycology 4th Edition, Cambridge University Press, New York.
7	Bold, H.C and Wynne, M.J. 1978. Introduction to the Algae: Structure and Function. Prantice Hall of India New Delhi.
<b>Web Resources:</b>	
1	<a href="https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382">https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382</a>
2	<a href="https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-">https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-</a>

	<a href="https://www.crcpress.com/Algae-Pereira/p/book/9781498755382">Algae/Pereira/p/book/9781498755382</a>
3	<a href="https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-Second-Edition/Barsanti-Gualtieri/p/book/9781439867327">https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-Second-Edition/Barsanti-Gualtieri/p/book/9781439867327</a>
4	<a href="https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678">https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678</a>
5	<a href="https://www.kopykitab.com/Botany-For-Degree-Students-ALGAE-by-B-R-Vashishta-Dr-A-K-Sinha-Dr-V-P-Singh">https://www.kopykitab.com/Botany-For-Degree-Students-ALGAE-by-B-R-Vashishta-Dr-A-K-Sinha-Dr-V-P-Singh</a>
6	<a href="https://www.wileyindia.com/a-textbook-of-algae.html">https://www.wileyindia.com/a-textbook-of-algae.html</a>
7	<a href="https://www.kobo.com/in/en/ebook/algae-biotechnology">https://www.kobo.com/in/en/ebook/algae-biotechnology</a>
8	<a href="https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-algae/9788188237449/">https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-algae/9788188237449/</a>

**Mapping with Programme Outcomes:**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	3	1	3	2	1	2	2	2	1
<b>CO 2</b>	3	3	2	2	3	3	2	1	3	3
<b>CO 3</b>	2	2	1	1	2	2	1	3	2	2
<b>CO 4</b>	3	3	3	3	3	2	3	3	3	2
<b>CO 5</b>	3	3	2	3	2	3	3	3	2	3

**S - Strong (3)**

**M - Medium (2)**

**L – Low (1)**

**Core – II – Plant Diversity – I – Algae – Practical**

<b>Title of the Course</b>	<b>Plant Diversity – I – Algae - Practical</b>						
<b>Paper Number</b>	<b>Core – II</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>3</b>	<b>Course Code</b>	<b>23U1BOCP01</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>	<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>		<b>Total</b>
	2		-		3		5
<b>Pre-requisite</b>	Students should be familiar with the basics of algae.						
<b>Learning Objectives:</b>							
<b>C1</b>	To develop skills to identify algae based on habitat, thallus structure and the internal organization.						
<b>C2</b>	To identify microalgae in a mixture.						
<b>C3</b>	To develop skills to prepare the microslides of algae.						
<b>C4</b>	To study the economic importance of few species.						
<b>C5</b>	To understand importance of algae to animals and humans.						
<b>Course Outcomes</b>	<b>On completion of this course, the students will be able to</b>						
<b>CO1</b>	Recall and identify algae using key identification characters.						<b>K1</b>
<b>CO2</b>	Demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture.						<b>K2</b>
<b>CO3</b>	Describe the internal structure of algae prescribed in the syllabus.						<b>K3</b>
<b>CO4</b>	Decipher the algal diversity in fresh/marine water and their economic significance.						<b>K4</b>
<b>CO5</b>	Evaluate the various techniques used to culture algae for commercial purposes.						<b>K5</b>

<b>Experiments</b>	
	<ol style="list-style-type: none"> <li>1. Micro-preparation of the types prescribed in the syllabus.</li> <li>2. Identifying the micro slides relevant to the syllabus.</li> <li>3. Identifying types of algal mixture.</li> <li>4. Economic importance of Algae as: (i) Food (ii) Feed (iii) Biofertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar Agar (viii) Alginate (ix) Diatomaceous earth.</li> <li>5. Field visit to study fresh water/marine water algal habitats.</li> <li>6. Visit to nearby industry actively engaged in algal technology.</li> </ol>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved. (To be discussed during the Tutorial hour)</p>
Skills acquired from this course	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.</p>
<b>Recommended Texts:</b>	<ol style="list-style-type: none"> <li>1. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.</li> <li>2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany-1 (10<sup>th</sup> Ed).Rastogi Publications, Meerut.</li> <li>3. Round, FE. 1984. The Ecology of Algae. Cambridge University Press.</li> <li>4. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani. ISBN: 978-9922-20-391-1.</li> <li>5. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.</li> </ol>
<b>Reference Books:</b>	<ol style="list-style-type: none"> <li>1. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying</li> <li>2. Manual to algae identification field guide, Ottawa Agriculture and Agri Food Canada Publisher.</li> <li>3. Chapman, V. J and Chapman, D. J. 1960.The Algae, ELBS and MacMillan, London.</li> <li>4. Lee, R.D. 2008. Phycology 4th Edition, Cambridge University Press, New York.</li> <li>5. Dehradun. Edwardlee, R. 2018. Phycology, 5<sup>th</sup> Ed., Cambridge University Press, London.</li> </ol>
<b>Web resources:</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.in/Practical-Manual-Algae-Sundara-Rajan/dp/8126106492">https://www.amazon.in/Practical-Manual-Algae-Sundara-Rajan/dp/8126106492</a></li> <li>2. <a href="https://books.google.co.in/books/about/Practical_Manual_of_Algae.html?id=8d5DAAAACAAJ&amp;redir_esc=">https://books.google.co.in/books/about/Practical_Manual_of_Algae.html?id=8d5DAAAACAAJ&amp;redir_esc=</a></li> <li>3. <a href="https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-(PDF-21P).html">https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-(PDF-21P).html</a></li> <li>4. <a href="https://www.ebooks.com/en-in/book/210152662/algae/sachin-kumar-mandotra/">https://www.ebooks.com/en-in/book/210152662/algae/sachin-kumar-mandotra/</a></li> <li>5. <a href="https://books.google.co.in/books/about/Algae.html?id=s1P855ZWc0kC&amp;redir_esc=y">https://books.google.co.in/books/about/Algae.html?id=s1P855ZWc0kC&amp;redir_esc=y</a></li> </ol>

**Mapping with Programme Outcomes:**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	1	3	2	1	2	3	2	1
<b>CO 2</b>	3	3	2	2	3	3	2	3	3	3
<b>CO 3</b>	2	2	3	3	1	2	1	3	1	2
<b>CO 4</b>	3	3	3	3	3	2	3	3	3	2
<b>CO 5</b>	3	3	2	2	2	3	3	3	2	3

**S - Strong (3)**

**M - Medium (2)**

**L – Low (1)**



**Non Major Elective - I**  
**Organic Farming**

<b>Title of the Course</b>	<b>Organic Farming</b>					
<b>Paper Number</b>	<b>Non Major Elective - I</b>					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>1</b>	<b>CourseCode</b>
		<b>Semester</b>	<b>I</b>			<b>23U1BOS01</b>
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>	
		2	-	-	2	
<b>Pre-requisite</b>		Students to gain knowledge on the scope of organic farming and its significance.				
<b>Learning Objectives:</b>						
<b>C1</b>	To enable students to gain knowledge on the scope of organic farming and its significance.					
<b>C2</b>	To impart practical insights sustainable agriculture, green manuring, recycling and composting.					
<b>C3</b>	To understand the physical and chemical properties of soil.					
<b>C4</b>	To study sustainable agriculture.					
<b>C5</b>	To know about the importance of biofertilizers.					
<b>Course Outcomes:</b>						
<b>COs</b>	<b>On completion of this course, the students will be able to:</b>				<b>POs</b>	
<b>CO1</b>	Recognize the different forms of biofertilizers and their uses.				<b>K1</b>	
<b>CO2</b>	Explain and interpret the components, patterns, and processes of bacteria for growth in crop production.				<b>K2</b>	
<b>CO3</b>	Apply techniques for synthesizing green manure and develop strategies to increase crop yield.				<b>K3</b>	
<b>CO4</b>	Analyze and decipher the significance of biofertilizers in soil fertility				<b>K4</b>	
<b>CO5</b>	Develop new strategies to enhance growth and quality check of medicinal herbs considering the practical issues pertinent to India.				<b>K5</b>	
<b>Unit</b>	<b>Contents</b>					
<b>I</b>	Soil – physical, chemical properties. Soil pollution – oil, chemicals –fertilizers, pesticide and herbicide, non-degradable solids, biomagnifications, consequences of land pollution – damage to soil and crops.					
<b>II</b>	Organic farming – definition, basic concept of organic farming, integrated plant nutrient supply management, integrated insect pest and disease management, integrated soil and water management. Sustainable agriculture practices-crop rotation, mixed cropping.					
<b>III</b>	Management of organic wastes and green manures: Farm manures, Composts, Mulches and pest control, importance of organic manure, importance of green manure, crops of green manure, oil cake. Animal based organic manure–cow dung, vermicompost-methods, production and utilization.					

<b>IV</b>	Biofertilizers – classification, nitrogen fixers– <i>Rhizobium</i> , Cyanobacteria, <i>Azolla</i> and Vesicular Arbuscular Mycorrhiza.
<b>V</b>	Recycling of bio-degradable municipal, agricultural and Industrial wastes – biocompost making methods.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Texts:</b>	<ol style="list-style-type: none"> <li>1. NIIR Board. 2012. The complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.</li> <li>2. Sathe, T.V. 2004. Vermiculture and Organic Farming. Daya publishers.</li> <li>3. Subba Rao N.S. 2017. Biofertilizers in Agriculture and Forestry. Fourth Edition. Medtech.</li> <li>4. Vayas, S. C, Vayas, S. and Modi, H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.</li> <li>5. Dongarjal, R.P and Zade, S.B. 2019. Insect Ecology and Integrated Pest Management Akinik Publications, New Delhi.</li> </ol>
<b>Reference Books:</b>	<ol style="list-style-type: none"> <li>1. Vayas, S. C, Vayas, S and Modi, H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.</li> <li>2. Sathe, T.V.2004. Vermiculture and Organic Farming. Daya publishers.</li> <li>3 Subha Rao, N.S.2000. Soil Microbiology, Oxford and IBH Publishers, New Delhi.</li> <li>4. Reddy, S.R. 2019. Fundamentals of Agronomy Kalyani Publications, Uttar Pradesh</li> <li>5. Tolanur, S. 2018. Fundamentals of Soil Science II<sup>nd</sup> Edition, CBS Publishers, New Delhi.</li> </ol>
<b>Web Resources:</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.com/Beginners-Practical-botanical-horticulture-landscape-ebook/dp/B00MOURUNY">https://www.amazon.com/Beginners-Practical-botanical-horticulture-landscape-ebook/dp/B00MOURUNY</a></li> <li>2. <a href="https://www.e-booksdirectory.com/listing.php?category=323">https://www.e-booksdirectory.com/listing.php?category=323</a></li> <li>3. <a href="http://www.freebookcentre.net/Biology/Agriculture-Books.html">http://www.freebookcentre.net/Biology/Agriculture-Books.html</a></li> <li>4. <a href="https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDF-downloads/TOFG-all.pdf">https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDF-downloads/TOFG-all.pdf</a></li> <li>5. <a href="https://www.amazon.in/s?k=the+organic+farming+manual&amp;hvadid=72636563575133&amp;hvbmt=bb&amp;hvdev=c&amp;hvqmt=b&amp;tag=msndeskstdin-21&amp;ref=pd_sl_6sbf0qtxcy_b">https://www.amazon.in/s?k=the+organic+farming+manual&amp;hvadid=72636563575133&amp;hvbmt=bb&amp;hvdev=c&amp;hvqmt=b&amp;tag=msndeskstdin-21&amp;ref=pd_sl_6sbf0qtxcy_b</a></li> </ol>

**Mapping with Programme Outcomes:**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	2	1	3	2	1	2	2	2	2
<b>CO 2</b>	3	3	2	1	2	3	2	3	2	3
<b>CO 3</b>	2	2	3	3	1	2	2	3	2	3
<b>CO 4</b>	3	2	1	1	2	3	2	3	2	3
<b>CO 5</b>	3	3	2	3	1	2	3	3	3	3

**S - Strong (3)**

**M - Medium (2)**

**L – Low (1)**

**Foundation Course for Botany  
Basics of Botany**

<b>Title of the Course</b>	<b>Basics of Botany</b>					
<b>Paper Number</b>	<b>Foundation Course</b>					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>1</b>	<b>Course Code</b>
		<b>Semester</b>	<b>I</b>			<b>23U1BO01</b>
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>
		2		-	-	2
<b>Pre-requisite</b>		To recall the students about the basic aspects of botany.				
<b>Learning Objectives:</b>						
<b>C1</b>	To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes.					
<b>C2</b>	To understand the biodiversity by describing and explaining the morphology and reproductive processes of algae, fungi, bryophytes and microorganisms.					
<b>C3</b>	To investigate the classification, distinctive traits, distribution and reproduction and life history of the various classes and major types of Pteridophytes and Gymnosperms.					
<b>C4</b>	Enable to learn various cell structures and functions of prokaryotes and eukaryotes and understand the salient features and functions of cellular organelles.					
<b>C5</b>	Understanding of laws of inheritance, genetic basis of loci and alleles.					
<b>Course Outcomes</b>	<b>On completion of this course, the students will be able to</b>					<b>Programme Outcomes</b>
<b>CO1</b>	Increase the awareness and appreciation of human friendly algae and their economic importance.					<b>K1</b>
<b>CO2</b>	Develop an understanding of microbes and fungi and appreciate their adaptive strategies.					<b>K2</b>
<b>CO3</b>	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.					<b>K3</b>
<b>CO4</b>	Compare the structure and function of cells and explain the development of cells.					<b>K4</b>
<b>CO5</b>	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.					<b>K5</b>

<b>Unit</b>	<b>Contents</b>
<b>I</b>	<b>Biodiversity:</b> Systematics: Two Kingdom and Five Kingdom systems - Salient features of various Plant Groups: Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms- Viruses - Bacteria.
<b>II</b>	<b>Cell Biology:</b> Cell as the basic unit of life - Prokaryotic and Eukaryotic Cell (Plant Cell) - Light Microscope and Electron Microscope Ultra Structure of Prokaryotic and Eukaryotic Cells - Cell Wall - Cell Membrane, Plastids and Ribosomes.

<b>III</b>	<b>Plant Morphology:</b> Structure and Modification of Root, Stem and Leaf - Structure and Types of Inflorescences - Structure and Types of Flowers, Fruits and Seeds.
<b>IV</b>	<b>Genetics:</b> Concept of Heredity and Variation - Mendel's Laws of Inheritance.
<b>V</b>	<b>Plant Physiology:</b> Cell as a Physiological Unit : Water relations -Absorption and movement : Diffusion, Osmosis, Plasmolysis, Imbibition -Permeability, Water Potential - Transpiration - Movement - Mineral Nutrition
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

<b>Recommended Texts:</b>	<ol style="list-style-type: none"> <li>1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.</li> <li>2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.</li> <li>3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.</li> <li>4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.</li> <li>5. Pandey B.P. 1986, Text Book of Botany (College Botany) Volume I and II, S. Chand and Co., New Delhi.</li> <li>6. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S. Viswanathan Pvt. Ltd., Madras.</li> </ol>
<b>Reference books:</b>	<ol style="list-style-type: none"> <li>1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.</li> <li>2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.</li> <li>3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand &amp; Company Ltd, Delhi.</li> <li>4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.</li> <li>5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand &amp; Company Ltd, Delhi.</li> <li>6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.</li> </ol>

<b>Web Resources:</b>	1. <a href="https://www.kobo.com/us/en/ebook/the-algae-world">https://www.kobo.com/us/en/ebook/the-algae-world</a> 2. <a href="http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html">http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html</a> 3. <a href="http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm">http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm</a> 4. <a href="https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/">https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/</a> 5. <a href="https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf">https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf</a> 6. <a href="https://www.us.elsevierhealth.com/medicine/cell-biology">https://www.us.elsevierhealth.com/medicine/cell-biology</a> 7. <a href="https://www.us.elsevierhealth.com/medicine/genetics">https://www.us.elsevierhealth.com/medicine/genetics</a> 8. <a href="https://www.kobo.com/us/en/ebook/plant-biotechnology-1">https://www.kobo.com/us/en/ebook/plant-biotechnology-1</a>
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**Mapping with Programme Outcomes:**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO 1</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 3</b>	2	3	3	3	3	1	3	3	1	3
<b>CO 4</b>	3	3	2	3	3	3	3	2	3	3
<b>CO 5</b>	3	2	2	2	2	2	2	1	2	2

**S - Strong (3)**

**M - Medium (2)**

**L – Low (1)**

**Core – III – Plant Diversity – II – Fungi, Bacteria, Viruses, Plant Pathology and Lichens**

<b>Title of the Course</b>		<b>Plant Diversity – II – Fungi, Bacteria, Viruses, Plant Pathology and Lichens</b>					
<b>Paper Number</b>		<b>Core – III</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>4</b>	<b>Course Code</b>	<b>23U2BOC02</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		<b>3</b>		<b>2</b>		<b>-</b>	<b>5</b>
<b>Pre-requisite</b>		Students should be familiar with the basics of fungi, bacteria, viruses and lichens.					
<b>Learning Objectives:</b>							
<b>C1</b>	To describe the common characteristics of fungi as being heterotrophic, unicellular/multicellular.						
<b>C2</b>	To understand the biology of fungi and to discuss the importance of fungi in various ecological roles						
<b>C3</b>	To understand lichen structure, function, identification, and ecology; Comprehend the events of symbiosis and lichenization and to demonstrate the use of lichens as bioindicator species.						
<b>C4</b>	To identify the main groups of plant pathogens, their symptoms.						
<b>C5</b>	To understand the various types of plant diseases.						
<b>Course Outcomes</b>	<b>On completion of this course, the students will be able to:</b>					<b>Programme Outcomes</b>	
<b>CO1</b>	Recognize the general characteristics of microbes, fungi and lichens and disease symptoms.					<b>K1</b>	
<b>CO2</b>	Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies based on structural organization.					<b>K2</b>	
<b>CO3</b>	Identify the common plant diseases, according to geographical locations and devise control measures.					<b>K3</b>	
<b>CO4</b>	Analyze the emerging trends in fungal biotechnology with special reference to agricultural and pharmaceutical applications.					<b>K4</b>	
<b>CO5</b>	Determine the economic importance of microbes, fungi and lichens					<b>K5</b>	
<b>Unit</b>	<b>Contents</b>						
<b>I</b>	<b>Fungi:</b> Classification of fungi - (Alexopoulos and Mims, 1979), criteria for classification, characteristic features, thallus organization, mode of nutrition, structure, reproduction and life-history of classes, each with one suitable						

	example: Zygomycotina ( <i>Pilobolus</i> , <i>Mucor</i> , <i>Rhizopus</i> ), Ascomycotina ( <i>Aspergillus</i> , <i>Saccharomyces</i> <i>Peziza</i> ), Basidiomycotina ( <i>Agaricus</i> , <i>Pleurotus</i> , <i>Puccinia</i> ) and Deuteromycotina ( <i>Cercospora</i> , <i>Alternaria</i> ). Importance of mycorrhizal association.
II	<b>Economic importance of fungi:</b> Cultivation of mushroom – <i>Pleurotus</i> (food). Fungi in agriculture application (biofertilizers): Mycotoxins (biopesticides), Production of industrially important products from fungi- alcohol (ethanol), organic acids (citric acid), enzymes (protease). Vitamins (Vitamin B-complex and Vitamin B-12), applications of fungi in pharmaceutical products (Penicillin). Importance of VAM fungi. Harmful effects of Fungi - Mycotoxins.
III	<b>Bacteria and Viruses:</b> Classification (Bergey's, 1994), structure and reproduction of bacteria, Mycoplasma, Virology -Viruses general characters, structure and reproduction.
IV	<b>Plant Pathology:</b> General symptoms of plant diseases; Geographical distribution of diseases; Etiology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of the following plant diseases. General characters of Bacteria and Viruses. <b>Bacterial diseases</b> – Citrus canker and Bacterial wilt of Banana <b>Viral diseases</b> – Tobacco Mosaic and Vein clearing of Papaya <b>Fungal diseases</b> – Blast disease in rice and Tikka disease
V	<b>Lichens:</b> Classification (Hale, 1969). Habitat, nature of association, Structure, Nature of Mycobionts and Phycobionts, Study of growth forms of lichens (crustose, foliose and fruticose), types, distribution, thallus organization, reproduction and ecological significance of lichens with special reference to <i>Usnea</i> . <b>Economic importance of Lichens:</b> food, fodder and nutrition, flavor, tanning and dyeing, cosmetics and perfumes, Brewing and distillation, minerals, Natural products, medicine (Ayurvedic, Siddha), pharmaceutical products, biodegradation agent, air pollution and biomonitoring, soil formation, nitrogen fixation, Harmful aspects, poison from lichens,
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill



<b>Recommended Texts:</b>	<ol style="list-style-type: none"> <li>1. Pandey, B.P. 1997. College Botany. Vol. I Fungi &amp; Pathology.</li> <li>2. Mehrotra, R.S and Aneja, K.R. 2003. An introduction to mycology. New age International (P) Ltd, Publishers, New Delhi.</li> <li>3. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.</li> <li>4. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.</li> <li>5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.</li> <li>6. Sharma, P.D. 2011. Plant Pathology, Rastogi Publication, Meerut, India.</li> <li>7. Mahendra Rai. 2009. Advances in Fungal Biotechnology. I.K. International Publishing House, New Delhi.</li> </ol>
<b>Reference Books:</b>	<ol style="list-style-type: none"> <li>1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. Introductory Mycology. 4th edition. John Wiley &amp; Sons (Asia) Singapore.</li> <li>2. Webster, J and Weber, R. 2007. Introduction to Fungi. 3rd edition. Cambridge University Press, Cambridge.</li> <li>3. Sharma, O.P. 2011. Fungi and allied microbes The McGraw –Hill companies, New Delhi.</li> <li>4. Burnett, J.H. 1971. The fundamentals of Mycology. ELBS Publication, London.</li> <li>5. Bessey, E.A. 1979. Morphology and Taxonomy of fungi, Vikas publishing House Pvt. Ltd, New Delhi.</li> <li>6. Dharani Dhar Awasthi. 2000. A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.</li> <li>7. Pelzer, M.J., Chan, E.C.S and Krieg, N.R. 1983. Microbiology, Tata McGraw Hill Publishing House, New Delhi.</li> <li>8. Pandey, P.B. 2014. College Botany- 1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.</li> <li>9. Mishra, A. and Agarwal, R.P. 1978. Lichens – A Preliminary Text. Oxford and IBH.</li> <li>10. Pandey, B.P. 2005. College Botany I: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S Chand &amp; Company</li> </ol>
<b>Web Resources:</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YFDDE">https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YFDDE</a></li> <li>2. <a href="http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html">http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html</a></li> <li>3. <a href="http://www.freebookcentre.net/Biology/Mycology-Books.html">http://www.freebookcentre.net/Biology/Mycology-Books.html</a></li> <li>4. <a href="https://www.kobo.com/us/en/ebook/introduction-to-fungi">https://www.kobo.com/us/en/ebook/introduction-to-fungi</a></li> <li>5. <a href="http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html">http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html</a></li> <li>6. <a href="http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html">http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html</a></li> </ol>

**Mapping with Programme Outcomes:**

<b>COs</b>	<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>CO1</b>	3	3	1	3	2	1	2	2	2	2
<b>CO 2</b>	3	3	2	2	3	3	2	1	2	1
<b>CO 3</b>	2	2	3	3	1	2	1	3	1	3
<b>CO 4</b>	3	3	3	3	3	2	3	3	3	3
<b>CO 5</b>	3	3	2	3	2	3	3	3	3	3

**S - Strong (3)**

**M - Medium (2)**

**L – Low (1)**

**Core – IV – Plant Diversity – II – Fungi, Bacteria, Viruses, Plant Pathology and Lichens – Practical - II**

<b>Title of the Course</b>		<b>Core – IV – Plant Diversity – II – Fungi, Bacteria, Viruses, Plant Pathology and Lichens – Practical –II</b>					
<b>Paper Number</b>		<b>Core IV</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>3</b>	<b>Course Code</b>	<b>23U2BOCP02</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		<b>2</b>	<b>-</b>	<b>3</b>	<b>5</b>		
<b>Pre-requisite</b>		Students should be familiar with the basics of fungi and lichens.					
<b>Learning Objectives&gt;</b>							
<b>C1</b>	To enable students to identify microscopic and macroscopic fungi.						
<b>C2</b>	To prepare microslides of fungi and lichens.						
<b>C3</b>	To know the presence of pathogen inside the plant tissues through microscopic sections.						
<b>C4</b>	To identify the bryophytes based on the morphology, and microslides.						
<b>C5</b>	To know the economic importance of the microbes studied.						
<b>Course Outcomes</b>	<b>Completion of this course, the students will be able to:</b>						<b>Programme Outcomes</b>
<b>CO1</b>	Identify microbes, fungi and lichens using key identifying characters						<b>K1</b>
<b>CO2</b>	Develop practical skills for culturing and cultivation of fungi.						<b>K2</b>
<b>CO3</b>	Identify and select suitable control measures for the common plant diseases.						<b>K3</b>
<b>CO4</b>	Analyze the characteristics of microbes, fungi and plant pathogens						<b>K4</b>
<b>CO5</b>	Access the useful role of fungi in agriculture and pharmaceutical industry						<b>K5</b>
<b>Experiments</b>							
<ol style="list-style-type: none"> <li>Microscopic observation of vegetative and reproductive structures of types of fungi prescribed in the syllabus through temporary preparations and permanent slides.</li> <li>Identifying the micro slides relevant to the syllabus.</li> <li>Herbarium specimens of bacterial diseases/photograph.</li> <li>Protocol for mushroom cultivation.</li> <li>Inoculation techniques for fungal culture (Demonstration only).</li> <li>Study of economically important products obtained from fungi: Fungal biofertilizers, biopesticides, biofungicide (<i>Trichoderma</i>), edible mushroom/Yeast, organic acids (citric acid) enzymes (protease), antibiotics and vitamins.</li> <li>Mycorrhiza: ecto-mycorrhiza and endo-mycorrhiza (Photographs).</li> </ol>							

7. Visit to fungal biotechnology laboratories.
8. Ultra structure of bacteria through literature.
9. Structure of bacteriophage.
10. Micro-preparation of *Usnea* to study vegetative and reproductive structures.
11. Identifying the micro slides of types of lichens relevant to the syllabus.
12. Study of thallus and reproductive structures (apothecium) through permanent slides.
13. Economic importance of Lichens - Dye and perfume.

**Recommended Texts:**

1. Chmielewski, J.G and Kravesky, D. 2013. General Botany laboratory Manual. AuthorHouse, Bloomington, USA.
2. Das, S and Saha, R. 2020. Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi, India.
3. Webster, J and Weber, R. 2007. Introduction to Fungi, 3<sup>rd</sup> Ed. Cambridge University Press, Cambridge.
4. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.
5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.

**Reference Books:**

1. Alexopoulos, J and Mims, W. 1985. Introductory Mycology, Wiley Eastern Limited New Delhi.
2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany 1 (10<sup>th</sup> ed). Rastogi Publications, Meerut.
3. Singh, R and U.C. Singh 2020. Modern mushroom cultivation, 3d Edition Agrobios (India), Jodhpur.
4. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.
5. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.

**Web resources:**

1. <https://www.amazon.in/Practical-Manual-Fungi-Fungicides/dp/B0025AEFP4>
2. [https://books.google.co.in/books/about/Practical\\_Mycology.html?id=5ycJAQAAMAAJ&redir\\_esc=y](https://books.google.co.in/books/about/Practical_Mycology.html?id=5ycJAQAAMAAJ&redir_esc=y)
3. <https://www.flipkart.com/colour-handbook-practical-plant-pathology/p/itmefsn6dyhfh9b>
4. [https://books.google.co.in/books/about/Practical\\_Botany.html?id=T5narQEACAAJ&redir\\_esc=y](https://books.google.co.in/books/about/Practical_Botany.html?id=T5narQEACAAJ&redir_esc=y)
5. <https://www.kobo.com/us/en/ebook/introduction-to-fungi>

**Mapping with Programme Outcomes:**

COs	COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	1	2	2	2	1
CO 2	2	3	2	2	3	3	2	3	3	3
CO 3	2	2	3	3	1	2	1	3	1	2
CO 4	3	3	3	3	3	2	3	3	3	2
CO 5	3	3	2	3	2	3	3	3	2	3

**S - Strong (3)**

**M - Medium (2)**

**L - Low (1)**

**Non Major Elective -II**  
**Mushroom Cultivation**

<b>Title of the Course</b>	<b>Mushroom Cultivation</b>					
<b>Paper Number</b>	<b>Non Major Elective -II</b>					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>1</b>	<b>CourseCode</b>
		<b>Semester</b>	<b>II</b>			<b>23U2BOS02</b>
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		<b>2</b>	<b>-</b>		<b>-</b>	<b>2</b>
<b>Pre-requisite</b>		Basic knowledge on structure and function of various groups of mushrooms.				
<b>Course Objectives:</b>						
<b>C1</b>	To learn and develop skills in mushroom cultivation.					
<b>C2</b>	To understand and appreciate the role of mushrooms in Nutrition, Medicine and health.					
<b>C3</b>	To cultivate mushroom cultivation in small scale industry.					
<b>C4</b>	To learn about diseases and post harvest technology.					
<b>C5</b>	To study new methods and strategies to contribute to mushroom production.					
<b>Course Outcomes:</b>	<b>On completion of this course, the students will be able to:</b>					<b>Programme Outcomes</b>
<b>CO1</b>	Recall various types and categories of mushroom.					<b>K1</b>
<b>CO2</b>	Explain about various types of food technologies associated with mushroom industry.					<b>K2</b>
<b>CO3</b>	Apply techniques studied for cultivation of various types of mushroom.					<b>K3</b>
<b>CO4</b>	Analyze and decipher the environmental factors and economic value associated with mushroom cultivation.					<b>K4</b>
<b>CO5</b>	Develop new methods and strategies to contribute to mushroom production.					<b>K5 &amp; K6</b>
<b>Unit</b>	<b>Contents</b>					
<b>I</b>	Introduction: Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms.					
<b>II</b>	Life cycle of <i>Pleurotus species</i> and <i>Agaricus species</i> .					
<b>III</b>	Spawn production, growth media, spawn running and harvesting of mushrooms and marketing.					
<b>IV</b>	Diseases and post harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases.					
<b>V</b>	Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry					

<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)</p>
<p>Skills acquired from this course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Recommended Texts:</b></p>	<ol style="list-style-type: none"> <li>1. Handbook of Mushroom Cultivation. 1999. TNAU publication.</li> <li>2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.</li> <li>3. Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.</li> <li>4. Sing. 2005. Modern Mushroom Cultivation, International Book Distributors, Dehradun.</li> <li>5. Verma, 2013. Mushroom: edible and medicinal: cultivation conservation, strainimprovement with their marketing. Daya Publishing House.</li> </ol>
<p><b>Reference Books:</b></p>	<ol style="list-style-type: none"> <li>1. Handbook of Mushroom Cultivation. 1999. TNAU publication.</li> <li>2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.</li> <li>3. Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.</li> <li>4. Nita Bahl. 2002. Handbook on Mushroom 4<sup>th</sup> edition Vijayprimlani for oxford &amp; IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.</li> <li>5. Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.</li> </ol>
<p><b>Web Resources:</b></p>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.in/Mushroom-Cultivation-India-B-C/dp/817035479X">https://www.amazon.in/Mushroom-Cultivation-India-B-C/dp/817035479X</a></li> <li>2. <a href="http://nrcmushroom.org/book-cultivation-merged.pdf">http://nrcmushroom.org/book-cultivation-merged.pdf</a></li> <li>3. <a href="http://agricoop.nic.in/sites/default/files/ICAR_8.pdf">http://agricoop.nic.in/sites/default/files/ICAR_8.pdf</a></li> <li>4. <a href="http://www.agrimoon.com/mushroom-culture-horticulture-icar-pdf-book/">http://www.agrimoon.com/mushroom-culture-horticulture-icar-pdf-book/</a></li> <li>5. <a href="https://books.google.co.in/books/about/Mushroom_Cultivation_in_India.html?id=6AJx99OGTKEC&amp;redir_esc=y">https://books.google.co.in/books/about/Mushroom_Cultivation_in_India.html?id=6AJx99OGTKEC&amp;redir_esc=y</a></li> </ol>

**Mapping with Programme Outcomes:**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>
<b>CO1</b>	3			3	2	1	2	2
<b>CO 2</b>	3			2		2	2	3
<b>CO 3</b>	2			3		2		3
<b>CO 4</b>	3	3	3	3		2		3
<b>CO 5</b>	3	3	2				3	3

**S - Strong (3)      M - Medium (2)      L – Low (1)**

### Elective Allied Botany - I

<b>Title of the Course</b>	<b>Allied Botany -I</b>					
<b>Paper Number</b>	<b>Core Allied -I</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>
		<b>Semester</b>	<b>I</b>			<b>23U1BOGE01</b>
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>	
		<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	
<b>Pre-requisite</b>		To study the basics of botany.				
<b>Learning Objectives:</b>						
<b>C1</b>	To study morphological and anatomical adaptations of plants of various habitats.					
<b>C2</b>	To demonstrate techniques of plant tissue culture.					
<b>C3</b>	To familiarize with the structure of DNA, RNA.					
<b>C4</b>	To carryout experiments related with plant physiology.					
<b>C5</b>	To perform biochemistry experiments.					
<b>Course Outcomes:</b>						
<b>COs</b>	On completion of this course, the students will be able to:					<b>POs</b>
<b>CO1</b>	Increase the awareness and appreciation of human friendly algae and their economic importance.					<b>K1</b>
<b>CO2</b>	Develop an understanding of microbes and fungi and appreciate their adaptive strategies					<b>K2</b>
<b>CO3</b>	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.					<b>K3</b>
<b>CO4</b>	Compare the structure and function of cells and explain the development of cells.					<b>K4</b>
<b>CO5</b>	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.					<b>K5</b>
<b>Unit</b>	<b>Contents</b>					
<b>I</b>	<b>Algae:</b> General characters of algae - Structure, reproduction and life cycle of the following genera - <i>Anabaena</i> and <i>Sargassum</i> and economic importance of algae.					
<b>II</b>	<b>Fungi, Bacteria and Virus:</b> General characters of fungi, structure, reproduction and life cycle of the following genera - <i>Penicillium</i> and <i>Agaricus</i> and economic importance of fungi. <b>Bacteria</b> - general characters, structure and reproduction of <i>Escherichia coli</i> and economic importance of bacteria. <b>Virus</b> - general characters, structure of TMV, structure of bacteriophage.					



<b>III</b>	<b>Bryophytes, Pteridophytes and Gymnosperms:</b> General characters of Bryophytes, Structure and life cycle of <i>Funaria</i> . General characters of Pteridophytes, Structure and life cycle of <i>Lycopodium</i> . General characters of Gymnosperms, Structure and life cycle of <i>Cycas</i> .
<b>IV</b>	<b>Cell Biology:</b> Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.
<b>V</b>	<b>Genetics and Plant Biotechnology:</b> Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - <i>In vitro</i> culture methods. Plant tissue culture and its application in biotechnology.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Texts:</b>	<ol style="list-style-type: none"> <li>1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.</li> <li>2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.</li> <li>3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.</li> <li>4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.</li> <li>5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S. Viswanathan Pvt. Ltd., Madras.</li> </ol>
<b>Reference books:</b>	<ol style="list-style-type: none"> <li>1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.</li> <li>2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.</li> <li>3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand &amp; Company Ltd, Delhi.</li> <li>4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.</li> </ol>

	<ol style="list-style-type: none"> <li>5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand and Company Ltd, Delhi.</li> <li>6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.</li> <li>7. Pandey B.P. 1986, Text Book of Botany (College Botany) Volume I and II, S. Chand and Co. New Delhi.</li> </ol>
<b>Web Resources:</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.kobo.com/us/en/ebook/the-algae-world">https://www.kobo.com/us/en/ebook/the-algae-world</a></li> <li>2. <a href="http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html">http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html</a></li> <li>3. <a href="http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm">http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm</a></li> <li>4. <a href="https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/">https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/</a></li> <li>5. <a href="https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf">https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf</a></li> <li>6. <a href="https://www.us.elsevierhealth.com/medicine/cell-biology">https://www.us.elsevierhealth.com/medicine/cell-biology</a></li> <li>7. <a href="https://www.us.elsevierhealth.com/medicine/genetics">https://www.us.elsevierhealth.com/medicine/genetics</a></li> <li>8. <a href="https://www.kobo.com/us/en/ebook/plant-biotechnology-1">https://www.kobo.com/us/en/ebook/plant-biotechnology-1</a></li> </ol>

**Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO 1</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 3</b>	2	3	3	3	3	1	3	3	3	3
<b>CO 4</b>	3	3	2	3	3	3	2	3	2	3
<b>CO 5</b>	3	2	2	2	2	2	2	1	2	1

**S - Strong (3)**

**M - Medium (2)**

**L – Low (1)**

### Elective Allied Botany - II

<b>Title of the Course</b>	<b>Allied Botany - II</b>					
<b>Paper Number</b>	<b>Core-Allied - II</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>
		<b>Semester</b>	<b>II</b>			<b>23U2BOGE02</b>
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>
		<b>3</b>		<b>1</b>	<b>-</b>	<b>4</b>
<b>Pre-requisite</b>		To study basics of botany.				
<b>Learning Objectives:</b>						
<b>C1</b>	To be familiar with the basic concepts and principles of plant systematics.					
<b>C2</b>	Learn the importance of plant anatomy in plant production systems.					
<b>C3</b>	Understand the mechanism underling the shift from vegetative to reproductive phase.					
<b>C4</b>	To learn about the physiological processes that underlie plant metabolism.					
<b>C5</b>	To know the energy production and its utilization in plants.					
<b>Course Outcomes:</b>						
<b>COs</b>	On completion of this course, the students will be able to:					
<b>CO1</b>	Understand the fundamental concepts of plant anatomy and embryology.					<b>POs</b>
<b>CO2</b>	Analyze and recognize the different organs of plants and secondary growth.					<b>K1</b>
<b>CO3</b>	Understand water relation of plants with respect to various physiological processes.					<b>K2</b>
<b>CO4</b>	Classify aerobic and anaerobic respiration.					<b>K3</b>
<b>CO5</b>	Classify plant systematics and recognize the importance of herbarium and virtual herbarium.					<b>K4</b>
<b>Unit</b>		<b>Contents</b>				
<b>I</b>		<b>Morphology of flowering plants:</b> Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.				
<b>II</b>		<b>Taxonomy:</b> Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae.				
<b>III</b>		<b>Anatomy:</b> Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.				

<b>IV</b>	<b>Embryology:</b> Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.
<b>V</b>	<b>Plant Physiology:</b> Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Texts</b>	<ol style="list-style-type: none"> <li>1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.</li> <li>2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P. K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.</li> <li>3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.</li> <li>4. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.</li> <li>5. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.</li> </ol>
<b>Reference books</b>	<ol style="list-style-type: none"> <li>1. Lawrence. G. H. M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.</li> <li>2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.</li> <li>3. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.</li> <li>4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.</li> <li>5. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.</li> <li>6. Jain, V.K. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd., New Delhi.</li> <li>7. Verma, S.K. 2006. A Textbook of Plant Physiology, S. K. Chand &amp; Co., New Delhi.</li> </ol>
<b>Web Resources:</b>	<ol style="list-style-type: none"> <li>1. <a href="https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&amp;redir_esc=y">https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&amp;redir_esc=y</a></li> <li>2. <a href="https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Ro">https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Ro</a></li> </ol>

	<p>0lwSXFnUC&amp;redir_esc=y</p> <p>3. <a href="https://archive.org/EXPERIMENTS/plantanatomy031773mbp">https://archive.org/EXPERIMENTS/plantanatomy031773mbp</a></p> <p>4. <a href="https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG">https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG</a></p> <p>5. <a href="https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692">https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692</a></p>
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**Mapping with Programme Outcomes:**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO 1</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 3</b>	2	3	3	3	3	1	3	3	3	3
<b>CO 4</b>	3	3	2	3	3	3	3	2	3	2
<b>CO 5</b>	3	2	2	2	2	2	2	1	2	2

**S - Strong (3)**

**M - Medium (2)**

**L – Low (1)**

### Elective Allied Botany Practical

<b>Title of the Course</b>	<b>Allied Botany Practical</b>					
<b>Paper Number</b>	<b>Core-Allied Practical – I</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>CourseCode</b>
		<b>Semester</b>	<b>II</b>			<b>23U2BOGEP01</b>
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		<b>1</b>	<b>-</b>		<b>3</b>	<b>4</b>
<b>Pre-requisite</b>		Practicals pertaining to above subjects are important to get knowledge on various aspects of plants.				
<b>Learning Objectives:</b>						
<b>C1</b>	To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.					
<b>C2</b>	To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.					
<b>C3</b>	To be familiar with the basic concepts and principles of plant systematics.					
<b>C4</b>	Understanding of laws of inheritance, genetic basis of loci and alleles.					
<b>C5</b>	To learn about the physiological processes that underlie plant metabolism.					
<b>Course Outcomes:</b>						
<b>Course Outcomes</b>	On completion of this course, the students will be able to:					<b>Programme Outcomes</b>
<b>CO1</b>	To study the internal organization of algae and fungi.					<b>K1</b>
<b>CO2</b>	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.					<b>K2</b>
<b>CO3</b>	To study the classical taxonomy with reference to different parameters.					<b>K3</b>
<b>CO4</b>	Understand the fundamental concepts of plant anatomy and embryology.					<b>K4</b>
<b>CO5</b>	5. To study the effect of various physical factors on photosynthesis.					<b>K5</b>
<b>Experiments</b>						
<ol style="list-style-type: none"> <li>1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.</li> <li>2. Micro photographs of the cell organelles ultra structure.</li> <li>3. Simple genetic problems.</li> <li>4. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family.</li> </ol>						

	<p>5. To dissect a flower, construct floral diagram and write floral formula.</p> <p>6. Demonstration experiments</p> <ol style="list-style-type: none"> <li>1. Ganong's Light screen</li> <li>2. Ganong's respiroscope</li> </ol> <p>7. To make suitable micro preparations of anatomy materials prescribed in the syllabus.</p> <p>8. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy, Embryology, Cell biology and Biotechnology.</p>
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)</p>
<p>Skills acquired from this course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Recommended Texts:</b></p>	<ol style="list-style-type: none"> <li>1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.</li> <li>2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.</li> <li>3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.</li> <li>4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.</li> <li>5. Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.</li> </ol>
<p><b>Reference Books:</b></p>	<ol style="list-style-type: none"> <li>1. Strickberger, M. W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.</li> <li>2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.</li> <li>3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.</li> <li>4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press &amp; Wiley Publications.</li> <li>5. Steward, F.C. 2012. Plant Physiology Academic Press, US</li> </ol>
<p><b>Web sources:</b></p>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883">https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883</a></li> <li>2. <a href="https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;gbpv=1&amp;dq=gy mnosperms&amp;printsec=frontcover">https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;gbpv=1&amp;dq=gy mnosperms&amp;printsec=frontcover</a></li> <li>3. <a href="https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ">https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ</a></li> </ol>

	4. <a href="https://medlineplus.gov/genetocs/understanding/basics/cell/">https://medlineplus.gov/genetocs/understanding/basics/cell/</a> 5. <a href="https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf">https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf</a> 6. <a href="http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf">http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf</a> 7. <a href="https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4">https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4</a>
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**Mapping with Programme Outcomes:**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO 1</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	3	3	3	3
<b>CO 3</b>	2	3	3	3	3	1	3	3	1	3
<b>CO 4</b>	3	3	2	3	3	3	3	2	3	3
<b>CO 5</b>	3	2	2	2	2	2	2	1	2	2

**S - Strong (3)**

**M - Medium (2)**

**L – Low (1)**