

Sardar Patel University, Mandi (H.P.)-175001

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Department of Botany



Scheme & Syllabi of Bachelor of Science 3-Years and 4-Years (Honours/ Honours with Research) in Life Sciences/Botany

Based on NEP 2020
Effective from 2026-27 onwards

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Programme: B.Sc. 3-Years and 4- Years (Hons. / Hons. with Research) in Life Sciences / Botany

Program Educational Objectives (PEOs)

The PEOs will enable students to

PEO-1: Develop a strong foundation in Life Sciences through the integrated study of Botany, Zoology, and Chemistry, enabling a comprehensive understanding of biological systems.

PEO-2: Equip students with analytical, practical, and research skills to investigate scientific problems and undertake independent research in specialized areas of Life Sciences/Botany.

PEO-3: Foster critical thinking, leadership, communication, teamwork, and ethical values for effective participation in multidisciplinary academic and professional environments.

PEO-4: Prepare graduates for higher education, research, entrepreneurship, and diverse career opportunities in academia, industry, healthcare, biotechnology, environmental management, and government sectors.

PEO-5: Promote lifelong learning, innovation, and social responsibility to contribute meaningfully towards sustainable development and the advancement of science and society.

Program Specific Outcomes (PSOs)

The B.Sc. 3-Years and 4- Years (Hons. / Hons. with Research) in Life Sciences / Botany programme is designed to

PSO-1: Apply fundamental concepts of Botany, Zoology, and Chemistry to understand the structure, function, diversity, and interactions of living systems.

PSO-2: Demonstrate proficiency in laboratory, field, and analytical techniques for investigating biological and chemical phenomena.

PSO-3: Analyze scientific data, employ appropriate computational and statistical tools, and solve problems using evidence-based approaches.

PSO-4: Evaluate issues related to biodiversity, environmental sustainability, health, and natural resource management through multidisciplinary perspectives.

PSO-5: Conduct independent research in a chosen specialization area, communicate scientific findings effectively, and uphold ethical and professional standards.

Program Outcomes (POs)

After successfully completing B.Sc. 3-Years and 4- Years (Hons. / Hons. with Research) in Life Sciences / Botany programme the students will be able to

PO1: Disciplinary Knowledge

Demonstrate comprehensive knowledge of fundamental concepts, principles, and applications of Life Sciences, including Botany, Zoology, Chemistry, and allied biological sciences.

PO2: Critical Thinking and Problem Solving

Apply scientific reasoning, analytical thinking, and quantitative approaches to identify, formulate, and solve biological problems.

PO3: Research Competency

Design and conduct experiments, collect and analyze data, interpret results, and communicate scientific findings using appropriate research methodologies.

PO4: Practical and Technical Skills

Demonstrate proficiency in laboratory techniques, field studies, instrumentation, specimen handling, and biological data analysis.

PO5: Environmental and Sustainability Awareness

Evaluate environmental challenges, biodiversity conservation issues, and sustainable utilization of biological resources for societal well-being.

PO6: Digital and Technological Competence

Utilize bioinformatics tools, information and communication technologies, statistical software, and digital resources in scientific investigations.

PO7: Communication Skills

Communicate scientific information effectively through oral presentations, technical reports, scientific writing, and collaborative discussions.

PO8: Ethics and Professional Responsibility

Apply ethical principles, biosafety regulations, and professional standards in scientific research and practice.

PO9: Leadership and Teamwork

Work effectively as an individual and as a member or leader of multidisciplinary teams in academic, research, and professional settings.

PO10: Lifelong Learning

Engage in self-directed learning and adapt to emerging developments in biological sciences, research, innovation, and entrepreneurship.

PO11: Multidisciplinary Integration

Integrate knowledge from biological, chemical, environmental, and technological sciences to address complex real-world problems.

PO12: Employability and Entrepreneurship

Develop competencies required for higher education, research careers, public services, biotechnology industries, environmental agencies, healthcare sectors, and entrepreneurial ventures.

Break-Down of Credits-Semester wise

Course Type/ Semester	DSC	DSE	MDC	SEC	AEC	VAC	INP/APT/PRT/COM or Vocation Course	DIS	Total
I	12	-	3	3	2	-	-	-	20
II	12	-	3	3	-	2	4	-	24
Exit option with UG Certificate after securing 44 credits along with entry option to second year or third semester									
III	8 (MJ)+4 (MN)	-	3	3	2	2	-	-	22
IV	8 (MJ)+4 (MN)	4	-	-	2	2	-	-	20
Exit option with UG Diploma after securing 86 credits along with entry option to third year or fifth semester									
V	8 (MJ)+4 (MN)	8	-	-	2	-	-	-	22
VI	8 (MJ)+4 (MN)	8	-	-	-	-	-	-	20
Award of 3 Year Bachelor's Degree after completion of 128 credits									
VII	12 (MJ)	4	-	-	-	-	-	4	20
VIII	8 (MJ)	4	-	-	-	-	-	8	20
Bachelor's Degree (Honours with Research) after completion of 168 credits									
Total Credits	(76MJ+16MN)	28	9	9	8	6	4	12	168

Abbreviations: DSC-Discipline Specific Core, DSE- Discipline Specific Elective, MDC-Multi-disciplinary Course, SEC-Skill Enhancement Course, AEC-Ability Enhancement Course, VAC-Value Added Course, MJ-Major, MN-Minor, INP/APT/PRT/COM-Internship / Apprenticeship/ Project/ Community Outreach, DIS-Dissertation

Important Notes

- In the first semester, students will be offered three different subjects within the same stream: A, B, and C.
- The student will be required to give his/her Major and Minor at the end of the second semester. Such choices, including DSCs made at the end of the second semester, shall remain in effect until the VI semester.
- The DSCs of other disciplines for the first two semesters of students who opt for Major programs will be treated as Minors.
- MDCs must be selected from a broad discipline/pool of MDCs other than Major and Minor disciplines/subjects.
- AEC/VAC/SEC should be chosen from a pool of courses. Every discipline shall provide these courses, some of which will be offered discipline-specific, while the rest can be open to students of all other disciplines. However, the two SECs (SEC-1 & SEC-2) must be chosen from the discipline-specific (Core and Minor).
- Internship / Apprenticeship/ Project/ Community Outreach will be determined at the end of the first semester to enable students to carry out some INP/APT/PRT/COM activities during winter vacation.
- To pursue an Honours & Honours with research in the 4th year, students will have to successfully complete 3-year UG Degree and choose only one discipline in both semesters, in which s/he have studied 6 DSCs and 5 DSEs in the first three years.
- A student who secures 75% or more marks in aggregate till semester 6 (up to a 3-year degree) shall be eligible for a 4-year degree Honours with Research, provided SPU has approved the college to offer it.
- The Dissertation and Project will start in the semester VII. However, the evaluation and assessment will be conducted in both the VII and VIII semesters.
- As permitted under the UGC Guidelines for Multiple Entry and Exit in Academic Programs offered in Higher Education Institutions, students will be allowed to enter/re-enter in the odd semesters and after even semesters, provided they fulfill the minimum requirements for entry and exit
- A student shall be eligible to appear in the end-semester examination only if s/he has a minimum of 75% attendance. The terms and rules governing condoning can be found in the Examination Section of the Ordinance.

Semester wise Scheme

Semester-I

S.N.	Course Code	Course Title	Category	L	T	P	C	CH	Theory Assessment		Practical Assessment		Total
									IA	ESE	IA	ESE	
1.	BBOTA-DSC-101T	Fundamentals of Phycology and Mycology Theory	DSC	3	0	0	3	3	25	50	-	-	75
2.	BBOTA-DSC-101P	Fundamentals of Phycology and Mycology Practical	DSC	0	0	1	1	2	-	-	5	20	25
3.	BXXXX*-DSC-101T		DSC	3	0	0	3	3	-	-	-	-	
4.	BXXXX-DSC-101P		DSC	0	0	-	-	2	-	-	-	-	
5.	BXXXX-DSC-101T		DSC	-	-	-	-	3	-	-	-	-	-
6.	BXXXX-DSC-101P		DSC	-	-	-	-	2	-	-	-	-	-
7.	BBOTA-MDC-101	Psychoactive Plants and Society	MDC	3	0	0	3	3	25	50	-	-	75
8.	BBOTA-SEC-101	Bio-fertilizers and Organic Farming	SEC	3	0	0	3	3	25	50	-	-	75
9.	BXXXX*-AEC-101		AEC	2	0	0	2	2	15	35	-	-	50
							20	23					
Total Cumulative Credits				20									

Abbreviations: L-Lecture, T-Tutorial, P-Practical, C-Credits, CH-Contact Hours, IA-Internal Assessment, ESE- End Semester Examination

Note: XXXX*- Short form of the department whose DSC/ AEC/ VAC (as mentioned in the column 'category' in the table) is offered in the curriculum

Semester-II

S.N.	Course Code	Course Title	Category	L	T	P	C	CH	Theory Assessment		Practical Assessment		Total
									IA	ESE	IA	ESE	
1.	BBOTA-DSC-201T	Bryology, Pteridology and Gymnosperms Biology Theory	DSC	3	0	0	3	3	25	50	-	-	75
2.	BBOTA-DSC-201P	Bryology, Pteridology and Gymnosperms Biology Practical	DSC	0	0	1	1	2	-	-	5	20	25
3.	BXXXX-DSC-201T	-	DSC	-	-	-	3	3	-	-	-	-	-
4.	BXXXX-DSC-201P	-	DSC	-	-	-	1	2	-	-	-	-	-
5.	BXXXX-DSC-201T	-	DSC	-	-	-	3	3	-	-	-	-	-
6.	BXXXX-DSC-201P	-	DSC	-	-	-	1	2	-	-	-	-	-
7.	BBOTA-MDC-201	Fundamentals of Horticulture	MDC	3	-	-	3	3	25	50	-	-	75
8.	BBOTA-SEC-201	Mushroom Cultivation Technology	SEC	3	-	-	3	3	25	50	-	-	75
9.	BXXXX-VAC-201	Environmental Education	VAC	2	-	-	2	2	15	35	-	-	50
10.	BBOTA-INP-101	INP/APT/PRT/COM	INP	0	0	4	4	12	100	-	-	-	100
Total							24	35					
Cumulative Credits							44						

Note: Exit option with UG Certificate after securing 44 credits (*with 4 credits of INP/APT/PRT/COM/ or work-based vocational course offered during winter/summer term), along with entry option to second year or third semester

Semester-III

S.N.	Course Code	Course Title	Category	L	T	P	C	CH	Theory		Practical		Total
									Assessment		Assessment		
									IA	ESE	IA	ESE	
1.	BBOTA-DSC-301T	Plant Systematics Theory	DSC (MJ)	3	0	0	3	3	25	50	-	-	75
2.	BBOTA-DSC -301P	Plant Systematics Practical	DSC (MJ)	0	0	1	1	2	-	-	5	20	25
3.	BXXXX-DSC-301T		DSC (MJ)	-	-	-	3	3	-	-	-	-	-
4.	BXXXX-DSC-301P		DSC (MJ)	-	-	-	1	2	-	-	-	-	-
5.	BXXXX-DSC-301T		DSC (MN)	-	-	-	3	3	-	-	-	-	-
6.	BXXXX-DSC-301P		DSC (MN)	-	-	-	1	2	-	-	-	-	-
7.	BBOTA-MDC-301	Nursery and Gardening	MDC	3	-	-	3	3	25	50	-	-	75
8.	BBOTA-SEC-301	Medicinal Plants and Ethnobotany	SEC	3	-	-	3	3	25	50	-	-	75
9.	BXXXX-AEC-301		AEC	2	-	-	2	2	15	35	-	-	50
10.	BBOTA.-VAC-301	Ancient Systems of Medicine	VAC	2	-	-	2	2	15	35	-	-	50
Total							22	35					
Cumulative Credits							66						

Semester-IV

S. N.	Course Code	Course Title	Category	L	T	P	C	CH	Theory		Practical		Total
									Assessment		Assessment		
									IA	ESE	IA	ESE	
1.	BBOTA-DSC-401T	Plant Physiology Theory	DSC (MJ)	3	-	-	3	3	25	50	-	-	75
2.	BBOTA-DSC-401P	Plant Physiology Practical	DSC (MJ)	-	-	1	1	2	-	-	5	20	25
3.	BXXXX-DSC-401T	--	DSC (MJ)	-	-	-	3	3	-	-	-	-	-
4.	BXXXX-DSC-401P	--	DSC (MJ)	-	-	-	1	2	-	-	-	-	-
5.	BXXXX-DSC-401T	--	DSC (MN)	-	-	-	3	3	-	-	-	-	-
6.	BXXXX-DSC-401P	--	DSC (MN)	-	-	-	1	2	-	-	-	-	-
7.	BBOTA-DSE-401T	Genetics and Evolution Theory	DSE	3	-	-	3	3	25	50	-	-	75
8.	BBOTA-DSE-401P	Genetics and Evolution Practical	DSE	-	-	1	1	2	-	-	5	20	25
9.	BXXXX-AEC-401	--	AEC	2	-	-	2	2	15	35	-	-	50
10.	BBOTA-VAC-401	Plants and	VAC	2	-	-	2	2	15	35	-	-	50

Scheme and Syllabi of B.Sc. 3-Years and 4- Years (Hons. / Hons. with Research) in Life Sciences / Botany
Programme for the Session 2026-27 Onwards

		Health												
Total							20	24						
Cumulative Credits							86							

Note: Exit option with UG Diploma after securing 86 credits along with entry option to third year or fifth semester

Semester-V

S.N.	Course Code	Course Title	Category	L	T	P	C	CH	Theory Assessment		Practical Assessment		Total
									IA	ESE	IA	ESE	
1.	BBOTA-DSC-501T	Plant Anatomy and Embryology Theory	DSC (MJ)	3	-	-	3	3	25	50	-	-	75
2.	BBOTA-DSC-501P	Plant Anatomy and Embryology Practical	DSC (MJ)	-	-	1	1	2	-	-	5	20	25
3.	BXXXX-DSC-501T		DSC (MJ)	3	-	-	3	3	-	-	-	-	-
4.	BXXXX-DSC-501P		DSC (MJ)	-	-	1	1	2	-	-	-	-	-
5.	BXXXX-DSC 501T		DSC (MN)	3	-	-	3	3	-	-	-	-	-
6.	BXXXX-DSC-501P		DSC (MN)	-	-	1	1	2	-	-	-	-	-
7.	BBOTA-DSE-501T	Ecology and Phytogeography Theory	DSE	3	-	-	3	3	25	50	-	-	75
8.	BBOTA-DSE-501P	Ecology and Phytogeography Practical	DSE	-	-	1	1		-	-	5	20	25
9.	BBOTA-DSE-502T	Cell and Molecular	DSE	3	-	-	3	3	25	50	-	-	75

Scheme and Syllabi of B.Sc. 3-Years and 4- Years (Hons. / Hons. with Research) in Life Sciences / Botany
Programme for the Session 2026-27 Onwards

		Biology Theory											
10.	BBOTA-DSE-502P	Cell and Molecular Biology Practical	DSE	-	-	1	1		-	-	5	20	25
11.	BXXXX-AEC-501	--	AEC	2	-	-	2	2	15	35	-	-	50
12.													
Total Cumulative Credits								108					

Semester-VI

S. N.	Course Code	Course Title	Category	L	T	P	C	CH	Theory		Practical		Total
									Assessment		Assessment		
									IA	ESE	IA	ESE	
1.	BBOTA-DSC-601T	Economic Botany and Plant Breeding Theory	DSC (MJ)	3	-	-	3	3	25	50	-	-	75
2.	BBOTA-DSC-601P	Economic Botany and Plant Breeding Practical	DSC (MJ)	-	-	-	1	2	-	-	5	20	25
3.	BXXXX-DSC-601T	-	DSC (MJ)	3	-	-	3	3	-	-	-	-	-
4.	BXXXX-DSC-601P	-	DSC (MJ)	-	-	-	1	2	-	-	-	-	-
5.	BXXXX-DSC- 601T	-	DSC (MN)	3	-	-	3	3	-	-	-	-	-
6.	BXXXX-DSC-601P	-	DSC (MN)	-	-	-	1	2	-	-	-	-	-

Scheme and Syllabi of B.Sc. 3-Years and 4- Years (Hons. / Hons. with Research) in Life Sciences / Botany
Programme for the Session 2026-27 Onwards

7.	BBOTA-DSE-601T	Biochemistry Theory	DSE	3	-	-	3	3	25	50	-	-	75
8.	BBOTA-DSE-601P	Biochemistry Practical	DSE				1	2	-	-	5	20	25
9.	BBOTA-DSE-602T	Plant Biotechnology Theory	DSE	3	-	-	3	3	25	50	-	-	75
10.	BBOTA-DSE-602P	Plant Biotechnology Practical	DSE				1	2	-	-	5	20	25
Total							20	24					
Total Cumulative Credits							128						

Note: Award of 3Year Bachelor's Degree after completion of 128 credits

Semester-VII

S.N.	Course Code	Course Title	Category	L	T	P	C	CH	Theory Assessment		Practical Assessment		Total
									IA	ESE	IA	ESE	
1.	BBOTA-DSC-701T		DSC (MJ)	3	-	-	3	3	25	50	-	-	75
2.	BBOTA-DSC-701P		DSC (MJ)				1	2	-	-	5	20	25
3.	BXXXX-DSC-702T		DSC (MJ)	3	-	-	3	3	25	50	-	-	75
4.	BXXXX-DSC-702P		DSC (MJ)				1	2	-	-	5	20	25
5.	BXXXX-DSC-703T		DSC (MJ)	3	-	-	3	3	25	50	-	-	75
6.	BXXXX-DSC-703P		DSC (MJ)				1	2	-	-	5	20	25
7.	BBOTA-DSE-701T		DSE	3	-	-	3	3	25	50	-	-	75
8.	BBOTA-DSE-701P		DSE				1	2	-	-	5	20	25
9.	BBOTA-DSE-702T		DSE	3	-	-	3	3	25	50	-	-	75

Scheme and Syllabi of B.Sc. 3-Years and 4- Years (Hons. / Hons. with Research) in Life Sciences / Botany
Programme for the Session 2026-27 Onwards

10.	BBOTA-DSE-702P		DSE				1	2	-	-	5	20	25	
Total							20	25						
Cumulative Credits							148							

Semester-VIII

S.N.	Course Code	Course Title	Category	L	T	P	C	CH	Theory Assessment		Practical Assessment		Total
									IA	ESE	IA	ESE	
1.	BBOTA-DSC-801T		DSC (MJ)	3	-	-	3	3	25	50	-	-	75
2.	BBOTA-DSC-801P		DSC (MJ)					2	-	-	5	20	25
3.	BXXXX-DSC-802T		DSC (MJ)	3	-	-	3	3	25	50	-	-	75
4.	BXXXX-DSC-802P		DSC (MJ)					2	-	-	5	20	25
5.	BBOTA-DSE-801T		DSE	3	-	-	3	3	25	50	-	-	75
6.	BBOTA-DSE-801P		DSE					2	-	-	5	20	25
7.	BBOTA-DSE-802T		DSE	3	-	-	3	3	25	50	-	-	75
8.	BBOTA-DSE-802P		DSE					2	-	-	5	20	25
9.	BBOTA-DSE-803T		DSE	3	-	-	3	3	25	50	-	-	75
10.	BBOTA-DSE-803P		DSE					2	-	-	5	20	25
Total													
Cumulative Credits							168						

Note: Bachelor's Degree (Honours with Research) after completion of 168 credits

Syllabus of B.Sc. 3-Years and 4-Years (Hons. /Hons. with Research) in Life Sciences/Botany Programme

S.N.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BBOTA-DSC- 101T	Fundamentals of Phycology and Mycology	3	0	0	3	45	Core
Prerequisite		Students should have a sound understanding of Fundamentals of Phycology and Mycology covered up to the +2 level.						

i. Course Objectives:

1. To make students familiar about the diverse life forms, life cycles, morphology, anatomy and importance of algae and fungi.
2. Understand the diversity and affinities among Algae and Fungi.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Classify algae and fungi based on their characteristics and structures.
CO2	Increase the awareness and appreciation of human friendly algae and fungi including their economic, ecological and evolutionary significance.
CO3	Obtain laboratory skills; explore algae and fungi for their commercial applications.

iii. Syllabus:

Section	Contents	Contact Hours
1	Diversity and Significance of Algae General characteristics of algae; Classification of algae up to family level according to Fritsch (1945); Thallus organization in algae; Pigment systems and their distribution; Nitrogen fixation by algae; Economic and ecological importance of algae. Single Cell Protein (SCP)	12 Hours

2	Study of Representative Algal Forms Comparative account of morphology, reproduction and life cycle (excluding developmental details) of the following genera: <i>Nostoc</i> (Cyanophyceae), <i>Oedogonium</i> (Chlorophyceae), <i>Vaucheria</i> (Xanthophyceae), <i>Ectocarpus</i> (Phaeophyceae), <i>Polysiphonia</i> (Rhodophyceae).	9 Hours
3	Diversity and Significance of Fungi General characteristics of fungi; Classification of fungi up to family level according to Alexopoulos and Mims (1979); Major types of fungal fruiting bodies; Mycorrhiza: structure, types and significance; Lichens: structure, forms and ecological importance; Economic importance of fungi.	14 Hours
4	Study of Representative Fungal Forms Comparative account of morphology, reproduction and life cycle (excluding developmental details) of representative members of major fungal groups: <i>Phytophthora</i> (Mastigomycotina), <i>Rhizopus</i> (Zygomycotina), <i>Penicillium</i> (Ascomycotina), <i>Puccinia</i> , <i>Agaricus</i> (Basidiomycotina), <i>Alternaria</i> (Deuteromycotina)	10 Hours

iv. Suggested readings:

1. Fritsch, F.E. (1945). The Structure and Reproduction of the Algae, Vol. I & II. Cambridge University Press.
2. Lee, R.E. (2018). Phycology (5th Ed.). Cambridge University Press.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, New Delhi.
4. Sharma, O.P. (2011). Textbook of Algae. McGraw Hill Education (India).
5. Alexopoulos, C.J., Mims, C.W. & Blackwell, M. (1996). Introductory Mycology (4th Ed.). John Wiley & Sons.
6. Webster, J. & Weber, R.W.S. (2007). Introduction to Fungi (3rd Ed.). Cambridge University Press.
7. Mehrotra, R.S. & Aneja, K.R. (2018). An Introduction to Mycology. New Age International Publishers, New Delhi.
8. Dube, H.C. (2013). An Introduction to Fungi. Scientific Publishers, Jodhpur.
9. Vashistha, B.R., Sinha, A.K. and Kumar, A. 2012. Botany for Degree Students - Fungi. S. Chand & Co. Ltd.

v. Evaluation Pattern:

Components	Internal Assessment	End Semester Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. N.	Type of Assessment	Marks
1	Assignments & Presentations	10 marks
2	Class Test/House Test	10 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%:1 Mark: 1; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Mid Semester Examination

S. N.	Particulars	Details
1	Maximum Marks	10 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A	Consists of four short-answer questions. All questions are compulsory. Each question carries 1 mark.

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	09	09
B	Section/Block II	2	Any 1	09	09
C	Section/Block III	2	Any 1	09	09

D	Section/Block IV	2	Any 1	09	09
E	All Sections/Blocks (I, II & III)	10 Short- Answer Questions	Any 7	02	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S.N.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%

S.N.	Course Code	Course Title	L	T	P	C	CH	Course Type
2	BBOTA-DSC-101 P	Fundamentals of Phycology and Mycology Practical	0	0	0	1	20	Core
Prerequisite		Students should have a sound understanding of Fundamentals of Phycology and Mycology covered up to the +2 level.						

- i. **Course Objectives:** To develop practical skills in the collection, identification, microscopic examination, and ecological understanding of algae, fungi, lichens, and mycorrhizae, along with basic microbiological laboratory techniques.
- ii. **Course Outcomes:** On completion of this course, the students are expected to

CO1	Collect algae, fungi, and lichens from diverse natural habitats and identify them using morphological characteristics.
CO2	Examine and describe the vegetative and reproductive structures of representative genera of Cyanophyta, Chlorophyta, Xanthophyta, Phaeophyta, Rhodophyta, and fungi Phytophthora, Rhizopus, Penicillium, Puccinia, Agaricus, Alternaria through temporary mounts and permanent slides.

CO3	Prepare temporary microscopic mounts of algal specimens and demonstrate proficiency in basic microscopic techniques.
CO4	Apply laboratory sterilization techniques and prepare culture media required for the cultivation and study of microorganisms.
CO5	Analyze the structure and ecological significance of mycorrhizal associations using permanent slides and photographic materials.
CO6	Investigate the morphology and classification of lichen specimens collected from different habitats and appreciate their ecological importance as bioindicators and symbiotic organisms.
CO7	Develop practical skills in specimen collection, preservation, microscopic observation, identification, and scientific documentation of lower plant groups and associated symbiotic forms.

iii. Syllabus:

S.N.	Aim of the Experiment
1.	Algal collection from different habitats and their identification.
2.	Study of vegetative and reproductive structures of some genera of Cyanophyta, Chlorophyta, Xanthophyta, Pheophyta and Rhodophyta.
3.	Preparation of temporary mount of algae mentioned in syllabus.
4.	Learning the methods of sterilization and media preparation.
5.	Study of vegetative and reproductive structures of fungal genera mentioned in theory from temporary mounts and permanent slides.
6.	Study of mycorrhiza through permanent slides or photographs.
7.	Collection of Lichen Specimens from Diverse Habitats and Their Morphological Study

iv. Suggested Readings:

1. Vashishta, B.R., Sinha, A.K. & Kumar, A. (2021). *Botany for Degree Students: Algae*. S. Chand Publishing, New Delhi.

2. Vashishta, B.R. & Sinha, A.K. (2021). *Botany for Degree Students: Fungi*. S. Chand Publishing, New Delhi.
3. Aneja, K.R. (2017). *Experiments in Microbiology, Plant Pathology and Biotechnology* (4th Ed.). New Age International Publishers, New Delhi.

v. Evaluation Pattern:

Components	Internal Assessment	Semester End Examination
Marks	5	20
Total Marks	25	

vi. Components of Internal Evaluation:

S. N.	Type of Assessment	Marks
1	Internal Assessment of Practical	5

vii. Instructions for End Semester Exam:

S. N.	Type of Assessment	Marks
1	Performance	10 Marks
2	Viva-Voce	5 Marks
3	Practical File/Record	5 Marks
4	Total	20 Marks

S.N.	Course Code	Course Title	L	T	P	C	CH	Course Type
2	BOTA-DSC-201 T	Bryology, Pteridology and Gymnosperm Biology	3	0	0	3	45	Core
Prerequisite		Students should have a sound understanding of Bryology, Pteridology and Gymnosperm Biology covered up to the +2 level.						

i. Course Objectives:

1. To make students familiar about the diverse life forms, life cycles, morphology, anatomy and importance of Bryophyta, Pteridophyta and Gymnosperm.
2. Understand the diversity and affinities among Bryophyta, Pteridophyta and Gymnosperm.

ii. Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1	Identify and classify representative members of Bryophyta, Pteridophyta, and Gymnosperms based on their morphological and anatomical characteristics.
CO2	Describe the vegetative and reproductive structures and life cycles of major groups of Bryophytes, Pteridophytes, and Gymnosperms.
CO3	Prepare and examine temporary mounts and permanent slides to study diagnostic features of these plant groups.
CO4	Compare the evolutionary trends and adaptations exhibited by Bryophytes, Pteridophytes, and Gymnosperms in the colonization of terrestrial habitats.
CO5.	Demonstrate proficiency in specimen collection, preservation, identification, and documentation of cryptogamic and gymnosperm diversity

iii. Syllabus:

Section	Contents	Contact Hours
1	General Topics General characters of Bryophytes, Pteridophytes, Gymnosperms and their recent classification; Range of gametophyte; Economic and ecological importance of Bryophytes. Heterospory; evolution of stele; brief account of apogamy and apospory; Economic importance of Pteridophytes and Gymnosperms.	16 Hours
2	Bryophytes Study of the following genera with respect to morphology, anatomy, reproduction and life cycle (excluding developmental details): <i>Marchantia</i> , <i>Anthoceros</i> and <i>Funaria</i> .	9 Hours
3	Pteridophytes Study of the following genera with respect to morphology, anatomy, reproduction and life cycle (excluding developmental details): <i>Selaginella</i> , <i>Equisetum</i> , <i>Adiantum</i> .	9 Hours
4	Gymnosperms Detailed study of: <i>Cycas</i> and <i>Pinus</i> with special reference to morphology, anatomy, reproduction and life cycle (excluding developmental details).	10 Hours

iv. Suggested readings:

1. Vashishta, B.R., Sinha, A.K. & Kumar, A. (2018). Botany for Degree Students: Bryophyta, Pteridophyta, Gymnosperms and Paleobotany. S. Chand Publishing, New Delhi.
2. Sharma, O.P. (2017). Bryophyta. McGraw Hill Education (India) Pvt. Ltd., New Delhi.
3. Sharma, O.P. (2017). Pteridophyta. McGraw Hill Education (India) Pvt. Ltd., New Delhi.
4. Bhatnagar, S.P. & Moitra, A. (2016). Gymnosperms. New Age International Publishers, New Delhi.
5. Singh, V., Pande, P.C. & Jain, D.K. (2021). A Textbook of Botany. Rastogi Publications, Meerut.

6. Goffinet, B. & Shaw, A.J. (2009). Bryophyte Biology (2nd Edition). Cambridge University Press, Cambridge, UK.
7. Ranker, T.A. & Haufler, C.H. (2008). Biology and Evolution of Ferns and Lycophytes. Cambridge University Press, Cambridge, UK.
8. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. & Donoghue, M.J. (2016). Plant Systematics: A Phylogenetic Approach (4th Edition). Sinauer Associates, Massachusetts, USA.
9. Raven, P.H., Evert, R.F. & Eichhorn, S.E. (2013). Biology of Plants (8th Edition). W.H. Freeman and Company, New York, USA.
11. Mauseth, J.D. (2019). Botany: An Introduction to Plant Biology (6th Edition). Jones & Bartlett Learning, Burlington, USA.

v. Evaluation Pattern:

Components	Internal Assessment	End Semester Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. N.	Type of Assessment	Marks
1	Assignments & Presentations	10 marks
2	Class Test/House Test	10 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%: 1 Mark: 1; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Mid Semester Examination

S. No.	Particulars	Details
1	Maximum Marks	10 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A	Consists of four short-answer

		questions. All questions are compulsory. Each question carries 1 mark.
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2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	09	09
B	Section/Block II	2	Any 1	09	09
C	Section/Block III	2	Any 1	09	09
D	Section/Block IV	2	Any 1	09	09
E	All Sections/Blocks (I, II & III)	10 Short-Answer Questions	Any 7	02	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S.N.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%

S.N.	Course Code	Course Title	L	T	P	C	CH	Course Type
2	BOTA-DSC-201 P	Practical Bryology, Pteridology and Gymnosperm Biology	0	0	0	1	20	Core
Prerequisite		Students should have a sound understanding of Bryology, Pteridology and Gymnosperm Biology covered up to the +2 level. covered up to the +2 level.						

- i. **Course Objectives:** To develop skills in the microscopic examination, sectioning, staining, and identification of Bryophytes, Pteridophytes, and Gymnosperms, and to understand their structural and reproductive diversity.
- ii. **Course Outcomes:** On completion of this course, the students are expected to

CO1	Identify and describe the morphological, anatomical, and reproductive features of representative Bryophytes, Pteridophytes, and Gymnosperms.
CO2	Prepare and interpret microscopic sections of plant specimens to study their internal structure.
CO3	Demonstrate proficiency in section cutting, staining, mounting, and handling of botanical specimens.
CO4	Prepare double-stained permanent mounts and use them for the identification of diagnostic characters.
CO5	Compare the structural and reproductive adaptations of Bryophytes, Pteridophytes, and Gymnosperms and explain their evolutionary significance.
CO6	Apply practical laboratory skills in specimen observation, documentation, and taxonomic identification of lower vascular and seed plants.

iii. **Syllabus:**

S.N.	Aim of the Experiment
1	Study of morphology, anatomy and reproduction of type specimens of bryophytes as mentioned in syllabus with the help of permanent slides. Section cutting procedure of bryophyta specimens.

2	Study of morphology, anatomy and reproduction of type specimens of pteridophytes as mentioned in syllabus with the help of permanent slides.
3	Study of morphology, anatomy and reproduction of type specimens of gymnosperms as mentioned in theory paper.
4	Preparation of double stained permanent mount of type specimens as mentioned in syllabus.

iv. Suggested Readings:

1. Bendre, A.M. & Kumar, A. – Practical Botany, Volume I
2. Pandey, B.P. (Latest Edition). College Botany, Volume I & II.

v. Evaluation Pattern:

Components	Internal Assessment	Semester End Examination
Marks	5	20
Total Marks	25	

vi. Components of Internal Evaluation:

S. N.	Type of Assessment	Marks
1	Internal Assessment of Practical	5

vii. Instructions for End Semester Exam:

S. N.	Type of Assessment	Marks
1	Performance	10 Marks
2	Viva-Voce	5 Marks
3	Practical File/Record	5 Marks
4	Total	20 Marks

Syllabus of B.Sc. 3-Years and 4-Years (Hons. /Hons. with Research) in Life Sciences/Botany Programme

S. No.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BBOTA-MDC – 101	Psychoactive Plants and Society	3	0	0	3	45	Core
Prerequisite		Students should have a understanding of Psychoactive Plants and Society						

i. Course Objectives:

1. Understanding the history, distribution and chemicals in psychoactive plants.
2. Understand the morphology and importance of some important psychoactive plants, their physiological action on human body and drug abuse.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Role of psychoactive plants in drug development.
CO2	Economic aspects of psychoactive plants.
CO3	Drug abuse Prevention, Rehabilitation and Community Participation.

iii. Syllabus:

Section	Contents	Contact Hours
1	Introduction Historical aspects; definition of psychoactive plants; distribution of psychoactive constituents in plant groups. Type of psychoactive drugs: stimulants, hallucinogens and depressants; medicinal use; designer drugs. Chemical nature of psychoactive drugs: Alkaloids and THC.	15 Hours

2	General account of some important psychoactive plants <i>Atropa belladonna, Cannabis sativa, Datura metel, Erythroxylon coca, Nicotiana tabacum, Papaver somniferum, Amanita muscaria, Psilocybe mexicana.</i>	15 Hours
3	Prevention of Drug Abuse and Legal Awareness Drug Abuse: development of drug abuse and drug addiction, deterioration of health, de-addiction; illegal trade names of Opium; drug trafficking. Highlights of NDPS Act - 1985. Understanding Addiction: Prevention, Rehabilitation and Community Participation.	15 Hours

iv. Suggested readings:

1. Kochhar, S.L. (2021). Economic Botany in the Tropics. Macmillan.
2. Sharma, O.P. (2022). Economic Botany. McGraw Hill.
3. Miller, W. R., & Carroll, K. M. (2011). *Rethinking Substance Abuse: What the Science Shows, and What We Should Do About It*. Guilford Press, New York.
4. Maisto, S. A., Galizio, M., & Connors, G. J. (2018). *Drug Use and Abuse* (8th Ed.). Cengage Learning.
5. Hart, C. L., & Ksir, C. (2022). *Drugs, Society, and Human Behavior* (19th Ed.). McGraw-Hill Education.

v. Evaluation Pattern:

Components	Internal Assessment	Semester End Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. N.	Type of Assessment	Marks
1	Assignments & Presentations	10 marks

2	Class Test/House Test	10 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%:1 Mark: 1; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Mid Semester Examination

S. No.	Particulars	Details
1	Maximum Marks	10 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A	Consists of four short-answer questions. All questions are compulsory. Each question carries 1 mark.

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	12	12
B	Section/Block II	2	Any 1	12	12
C	Section/Block III	2	Any 1	12	12
D	All Sections/Blocks (I, II & III)	10 Short-Answer Questions	Any 7	2	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S. No.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%

S.N.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BBOTA-MDC-201	Fundamentals of Horticulture	3	0	0	3	45	Core
Prerequisite		Students should have a sound understanding of Fundamentals of Horticulture covered up to the +2 level.						

i. Course Objectives:

1. Understanding fundamentals of Horticulture, and its importance.
2. Understanding various Horticultural techniques.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Establishment and rejuvenation of orchards.
CO2	Knowledge regarding different propagation methods along with recent application of Horticultural techniques.
CO3	Important fruit crops and their economic significance

iii. Syllabus:

Section	Contents	Contact Hours
1	Introduction to Horticulture Definition, scope and importance of horticulture; Branches of horticulture; Role of horticulture in nutrition, livelihood generation	15 Hours

	and environmental sustainability; Urban gardening and eco-friendly horticultural practices.; Ornamental plants: Common ornamental plants and their uses.; Plant propagation: Basic concepts of seed propagation, cutting, layering and grafting.	
2	Fruit Cultivation in Himachal Pradesh Major fruit-growing zones of Himachal Pradesh (HP); Important fruit crops and their economic significance; Nutritional importance of fruits; Orchard establishment: Selection of site, planting methods and basic orchard care; Soil health and orchard maintenance; Fruit drop: Causes and simple management practices.	15 Hours
3	Modern Horticultural Practices and Entrepreneurship Orchard management and rejuvenation; Organic manures and fertilizers in horticultural crops; Water management and introduction to irrigation methods; Drip irrigation and hydroponics; Protected cultivation and nursery management; Horticulture entrepreneurship, self-employment and career opportunities.	15 Hours

iv. Suggested readings:

1. Chadha, K.L. (2020). Handbook of Horticulture. ICAR, New Delhi.
2. Kumar, N. (2021). Introduction to Horticulture. Scientific Publishers, Jodhpur.
3. Singh, J. (2022). Fundamentals of Horticulture. Kalyani Publishers, New Delhi.
4. Jindal, K.K. and Gautam, D.R. (2020). Fruit Production in Temperate Regions. Kalyani Publishers, New Delhi.
5. Kumar, R. and Sharma, S.D. (2021). Horticulture in India: Prospects and Challenges. Scientific Publishers, Jodhpur.
6. Hartmann, H.T., Kester, D.E., Davies, F.T. and Geneve, R.L. (2018). Plant Propagation: Principles and Practices (9th Edition). Pearson Education, USA.
7. Acquaah, G. (2020). Horticulture: Principles and Practices (6th Edition). Pearson Education, USA.
8. Reiley, H.E. and Shry, C.L. (2017). Introductory Horticulture (9th Edition). Cengage Learning, USA.

9. Singh, H.P., Sharma, S.K. and Samuel, J.C. (2023). Advances in Indian Horticulture. New India Publishing Agency, New Delhi.

v. Evaluation Pattern:

Components	Internal Assessment	End Semester Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. N.	Type of Assessment	Marks
1	Assignments & Presentations	10 marks
2	Class Test/House Test	10 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%:1 Mark: 1; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Mid Semester Examination

S. N.	Particulars	Details
1	Maximum Marks	10 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A	Consists of four short-answer questions. All questions are compulsory. Each question carries 1 mark.

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	12	12
B	Section/Block II	2	Any 1	12	12
C	Section/Block III	2	Any 1	12	12
D	All Sections/Blocks (I, II & III)	10 Short-Answer Questions	Any 7	2	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S. No.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%

S.N.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BBOTA-SEC- 101	Biofertilizers and Organic Farming	3	0	0	3	45	Core
Prerequisite		Students should have a sound understanding bio- fertilizers and organic farming of covered up to the +2 level.						

i. Course Objectives:

The objective of the course is to make students gain knowledge on organic agriculture and use of eco-friendly biofertilizers like *Rhizobium*, *Azospirillum* and mycorrhizae, their identification, multiplication and recycling of the organic waste.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Develop their understanding on the concept of organic agriculture, certification Process, product labelling and regulatory mechanisms.
CO2	Identify the different forms of organic manures and biofertilizers, methods of their production and application for better crop production and their uses.
CO3	To develop knowledge and practical skills in Organic Farming for sustainable crop production, soil health improvement, resource conservation, and environmental sustainability.

iii. Syllabus:

Section	Contents	Contact Hours
1	Fertilizers: introduction, types of fertilizers and their advantages and disadvantages; brief account of microbes used as biofertilizers; marketable forms of biofertilizers. General account, isolation, identification, mass multiplication, carrier based inoculants, application and crop response of <i>Rhizobium</i> , <i>Azotobacter</i> and <i>Azospirillum</i> ; General account on phosphate solubilizing microorganisms (PSMs).	15 Hours
2	Cyanobacteria (BGA): <i>Azolla</i> and <i>Anabaena</i> association, nitrogen	

	fixation, factors affecting growth, blue green algae and <i>Azolla</i> in rice cultivation. Mycorrhizal Association: Types of mycorrhizal association, VAM - isolation, inoculum production, influence on growth and yield of crop plants.	15 Hours
3	Organic Farming: Concept and Scope; Green manuring and organic fertilizer, recycling of Biodegradable municipal, agricultural industrial wastes- biocompost making methods; Vermicompost, types and methods of Vermi-composting and advantages.	15 Hours

iv. Suggested readings:

1. Dubey, R.C. (2021). A Textbook of Biotechnology. S. Chand & Co., New Delhi.
2. Thakur, A.K., Bassi, S.K. & Singh, K.J. (2019). Biofertilizers. Dinesh Scientific Publishers, Jalandhar.
3. Subba Rao, N.S. (2019). Soil Microbiology. MedTech Science Press.
4. Palaniappan, S.P. & Annadurai, K. (2020). Organic Farming: Theory and Practice. Scientific Publishers.
5. Vessey, J.K. (2021). Biofertilizers and Sustainable Agriculture. CRC Press.
6. Singh, J.S., Pandey, V.C. & Singh, D.P. (2022). Biofertilizers in Sustainable Agriculture. Springer.
7. Bhattacharyya, P.N. & Jha, D.K. (2020). Plant Growth Promoting Rhizobacteria. Academic Press.
8. Yadav, A.K. (2023). Organic Farming and Biofertilizer Technology. New India Publishing Agency.
9. Palekar, S. (2016). *The Philosophy of Spiritual Farming (Zero Budget Natural Farming)*. Zero Budget Natural Farming Research, Development & Extension Movement, Amravati, Maharashtra.
10. Khosla, R. (2017). Biofertilizers and Biocontrol Agents for Organic Farming Kojo Press.

v. Evaluation Pattern:

Components	Internal Assessment	Semester End Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. No.	Type of Assessment	Marks
1	Assignments & Presentations	10 marks
2	Class Test/House Test	10 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%:1 Mark : 1; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Mid Semester Examination

S. No.	Particulars	Details
1	Maximum Marks	10 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A	Consists of four short-answer questions. All questions are compulsory. Each question carries 1 mark.

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	12	12
B	Section/Block II	2	Any 1	12	12
C	Section/Block III	2	Any 1	12	12
D	All Sections/Blocks (I, II & III)	10 Short-Answer Questions	Any 7	2	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S. N.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%

S.N.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BBOTA-SEC – 201	Mushroom Cultivation Technology	3	0	0	3	45	Core
Prerequisite		Students should have a sound understanding of Mushroom covered up to the +2 level.						

i. Course Objectives:

1. To enable the students to identify edible and poisonous mushrooms.
2. Provide hands on training for the preparation of bed for mushroom cultivation and spawn production
3. Give the students exposure to the experiences of experts and functioning mushroom farms.
4. Help the students to learn a means of self-employment and income generation.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Identify edible types of mushroom
CO2	Gain the knowledge of cultivation of different types of edible mushrooms; spawn production, harvesting and storage.
CO3	Learn a means of self-employment and income generation.

iii. Syllabus:

Section	Contents	Contact Hours
1	Introduction, history. nutritional and medicinal value of edible mushrooms; nutrition and nutraceuticals - proteins, amino acids, minerals, carbohydrates, crude fibre contents and vitamins; poisonous mushrooms; Research centres - National level and Regional level. General account of wild growing edible mushrooms.	15 Hours
2	General account of instruments used in mushroom cultivation; compost production, mushroom bed preparation; Medium preparation and sterilization; Pure culture isolation; Preparation of spawn and multiplication.	15 Hours
3	Cultivation technology of <i>Agaricus bisporus</i> and <i>Pleurotus</i> sp.; short-term storage (refrigeration - upto 24 hours), Value addition and long-term storage (canning, pickels, papads), drying, storage in salt solutions. Problems in mushroom cultivation - diseases, pests, nematodes, weed moulds and their management strategies.	15 Hours

iv. Suggested readings:

1. Sharma, V.P., Annepu, S.K. & Gautam, Y. (2022). Mushroom Cultivation Technology. ICAR– Directorate of Mushroom Research, Solan.
2. Pathak, Y. & Singh, M. (2021). Mushroom Production and Processing Technology. New India Publishing Agency.
3. Tripathi, D.P. (2020). Mushroom Cultivation. Oxford & IBH Publishing Co., New Delhi.
4. Krishnamoorthy, A.S., Marimuthu, T. & Nakkeeran, S. (2019). Mushroom Biotechnology. TNAU Press, Coimbatore.
5. Atri, N. S., Kour, H., & Kaur, M. (2019). *Wild Mushrooms – Collection and Identification*. Today and Tomorrow's Printers and Publishers, New Delhi.
6. Dhar, B.L. & Sharma, S.R. (2018). Advances in Mushroom Production. ICAR Publications.
7. Chang, S.T. & Miles, P.G. (2019). Mushrooms: Cultivation, Nutritional Value and Environmental Impact. CRC Press.

8. Sharma, V. P., Annepu, S. K., & Gautam, Y. (2017). *Mushroom Production and Processing Technology*. ICAR–Directorate of Mushroom Research, Solan.
9. Stamets, P. (2021). *Growing Gourmet and Medicinal Mushrooms*. Ten Speed Press.
10. Singh, M. & Vijay, B. (2023). *Modern Mushroom Cultivation and Entrepreneurship*. Scientific Publishers, Jodhpur.

v. Evaluation Pattern:

Components	Internal Assessment	Semester End Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. No.	Type of Assessment	Marks
1	Assignments & Presentations	10 marks
2	Class Test/House Test	10 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%:1 Mark : 1; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Mid Semester Examination

S. No.	Particulars	Details
1	Maximum Marks	10 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A	Consists of four short-answer questions. All questions are compulsory. Each question carries

		1 mark.
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2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	12	12
B	Section/Block II	2	Any 1	12	12
C	Section/Block III	2	Any 1	12	12
D	All Sections/Blocks (I, II & III)	10 Short-Answer Questions	Any 7	2	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S. No.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%