

**SWAMI RAMANAND TEERTH  
MARATHWADA UNIVERSITY,  
NANDED - 431 606 (MS)**



**(Credit Framework and Structure of Four Year UG Program with  
Multiple Entry and Exit Option as per NEP-2020)**

**UNDERGRADUATE PROGRAMME OF  
SCIENCE & TECHNOLOGY**

Major in **BOTANY** and Minor in **DSM** (Subject)

**Under the Faculty of Science & Technology**  
*(Revised as per the Govt. of Maharashtra circular dt. 13<sup>th</sup> March 2024)*

### *From the Desk of the Dean, Faculty of Science and Technology*

Swami Ramanand Teerth Marathwada University, Nanded, enduring to its vision statement “*Enlightened Student: A Source of Immense Power*”, is trying hard consistently to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching-learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve *the 3Es, the equity, the efficiency and the excellence* in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the cumulative grade point average (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the Choice Based Credit System (CBCS) in the year 2018-2019 at graduate and post-graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high calibre graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario.

Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy 2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. As a result the

students will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals.

The curriculum given in this document has been developed following the guidelines of NEP-2020 and is crucial as well as challenging due to the reason that it is a transition from general science based to the discipline-specific-based curriculum. All the recommendations of the *Sukanu Samiti* given in the **NEP Curriculum Framework-2023** have been followed, keeping the disciplinary approach with rigor and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology of this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students. We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the **Government of Maharashtra regarding NEP-2020**. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines.

We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employability. Introduction of the mandatory ***On Job Training, Internship program*** for science background students is praise worthy and certainly help the students to imbibe firsthand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

**Dr. M. K. Patil**  
***Dean***  
**Faculty of Science and Technology**

## *From Desk of Chairman, Board of Studies of the Subject Botany*

### **PREAMBLE**

The B.Sc. Botany semester pattern course is running in different affiliated colleges of the S.R.T.M.U. Nanded. The program is designed to encourage and support the growing demands and challenging trends in the academic environment. Our training focuses on holistic development of students to face the competitive world. The course content has been designed on NEP-2020 pattern. The program consists of Major (C), Minor (M), Generic Electives (GE), Vocational and Skill Enhancement Course (VSEC). The course content of each theory paper is divided into four units by giving appropriate titles and subtitles. For each unit, total number of periods required, weightage of maximum marks and credits are mentioned. A list of practical exercises for laboratory course work based on theory papers to be completed in the academic year is also given. A list of selected reading material and a common skeleton question paper for all the theory papers of semester-I &II are also provided at the end of the syllabus.

The programme also inculcates various attributes at the Honours level. These attributes encompass values related to emotional stability, social justice, creative and critical thinking, well-being and various skills required for employability, thus preparing students for continuous learning and sustainability. The new curriculum based on learning outcomes of BSc (Honours) Botany offers knowledge of areas including Plant Systematics, Plant Biotechnology, Resource Botany, Genetics, Ecology, Conservation biology, Physiology and Bioinformatics, Medicinal plants, Plant diseases management etc. The courses define clearly the objectives and the learning outcomes, enabling students to choose the elective subjects broadening their skills in the field of Botany. The course also offers skills to pursue research and teaching in the field of Botany and thus would produce best minds to meet the demands of society This curriculum framework for the bachelor-level program in Botany is developed keeping in view of the student-centric learning pedagogy, which is entirely outcome-oriented and curiosity-driven. To avoid a rote-learning approach and foster imagination, the curriculum is more leaned towards self-discovery of concepts. The curriculum framework focuses on the pragmatist approach whereby practical application of theoretical concepts is taught with substantial coverage of practical and field works. The addition of Generic Electives, Vocational and Skill Enhancement Courses aims to develop skills in plant sciences and practical experience in the students.

### **OBJECTIVES OF THE B. Sc. BOTANY PROGRAMME:**

**The Objective of this program are :**

1. Understand the scope and importance of discipline.
2. Instill a love and curiosity for nature through living plants.

3. To make students open-minded and curious, we try our best to nurture and develop scientific Attitude.
4. We make students fit for society by enabling them to work hard.
5. Make the students exposed to the diverse life forms.
6. Make them skilled in practical work, experiments, laboratory equipment and to interpret correctly on biological materials and data.
7. Develop interest in Biological research.
8. Encourage students to research related topics.
9. Develop a thirst for protecting natural resources and the environment.
10. Develop the ability to use the knowledge acquired in various spheres of life to make our country self-reliant
11. Appreciate and apply ethical principles to biological science research and practice.

#### **PROGRAM SPECIFIC OUTCOMES (PSO) OF B.Sc. BOTANY:**

**By the end of the program the students will be able to:**

- PO1:** Skill development for the proper description using botanical terms, identification, naming and classification of life forms especially plants and microbes.
- PO2:** Acquisition of knowledge on structure, life cycle and life processes that exist among plant and microbial diversity through certain model organism studies.
- PO3:** Understanding of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.
- PO4:** Understanding of the major elements of variation that exist in the living world through comparative morphological and anatomical study.
- PO5:** Ability to explain the diversity and evolution based on the empirical evidences in morphology, anatomy, embryology, physiology, biochemistry, molecular biology and life history.
- PO6:** Skill development for the collection, preservation and recording of information after observation and analysis- from simple illustration to molecular database development.
- PO7:** Making aware of the scientific and technological advancements- Information and Communication, Biotechnology and Molecular Biology for further learning and research in all branches of Botany..
- PO8:** Internalization of the concept of conservation and evolution through the channel of spirit of inquiry.
- PO9:** To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC etc.

- PO10:** To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules.
- PO11:** The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDGs, green technologies etc at the right opportunity.
- PO12:** The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and in the professional career.
- PO13:** The program enables the students to face NET, SET, MPSC, UPSC and other competitive examinations successfully.

**Dr. Saheb Laxmanrao Shinde**  
**Chairman,**  
**Board of Studies in Botany**  
**Swami Ramanand Teerth Marathwada University,**  
**Nanded**



***Details of the Board of Studies Members in the subject Botany under the faculty of Science & Technology of S.R.T.M. University, Nanded***

Sr No	Name of the Member	Designation	Address	Contact No.
1.	<b>Dr. Saheb Laxmanrao Shinde</b>	Chairman	Yeshwant Mahavidyalya, Nanded	7588151967
2	<b>Dr. Babasaheb Shivmurti Surwase</b>	Member	School of Life Sciences, S.R.T.M.U. Nanded	9075829767
3	<b>Dr. B. D. Gachande</b>	Member	Science College, Nanded	8788727840
4	<b>Dr Vijay Tulshiram Gorgile</b>	Member	Shahir Annabhau Sathe Mahavidyalaya, Mkhed	9421762073
5	<b>Dr. Sudhakar V. Chate</b>	Member	Shivaji College, Udgir	8421241300
6	<b>Dr. Suresh Manoharrao Telang</b>	Member	Yeshwant Mahavidyalaya, Nanded	9822174684
7	<b>Dr. R. M. Kadam</b>	Member	M. G. M. Ahmedpur, Tq. Ahmedpur, Dist. Latur.	9422657976
8	<b>Dr. Sopan Dnyanoba Dhavale</b>	Member	Shahir Annabhau Sathe Mahavidyalaya, Mukhed,	9423614703
9.	<b>Dr. Sanjay Marotrao Dalvi</b>	Member	Shri Guru Buddhiswami Mahavidyalaya, Purna (Jn),	9921101210
10	<b>Dr. Prashant A. Gawande</b>	Professor from other University	Sant Gadge Baba Amravati University, Amravati.	9403622568
11	<b>Dr. Ambadas Sheshrao Kadam</b>	Experts	DSM College Parbhani.	8329151172
12	<b>Dr. Kanhaiya Ranganathrao Kadam</b>	Experts	K.K. Herbal Industries, Gut No. 252, Naleshwar Road, Limbgaon, Nanded.	9420261080
13	<b>Bindu Maurya</b>	Experts	07, Mangal Pravesh building Polt. C-16 Sector-3 Airoli, Navi Mumbai.	9987591561
14	<b>Shri Bhanudas Balajirao Pendkar</b>	Experts	K-Ferts Lab, W-4, MIDC Industrial Area, Nanded. Invitee Member	8888896710



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Faculty of Science and Technology (Three Optional in the First Year)**

**Credit Framework for Four Year Multidisciplinary Degree Program**

**with Multiple Entry and Exit**

Subject: **BOTANY** (Major) / **ZOOLOGY & CHEMISTRY** (Minor 1 and Minor 2)

(For illustration **BOT**, **ZOO** and **CHE** combinations are considered, which may change for different combinations)

Year & Level	Sem ester	Optional 1 (Major) <i>(From the same Faculty)</i>	Optional 2 (Minor 1) <i>(From the same Faculty)</i>	Optional 3 (Minor 2) <i>(From the same Faculty)</i>	Generic Elective (GE) <i>(select from Basket 3 of Faculties other than Science and Technology)</i>	Vocational & Skill Enhancement Course	Ability Enhancement Course (AEC) <b>(Basket 4)</b> Value Education Courses (VEC) / Indian Knowledge System (IKS) <b>(Basket 5)</b> <i>(Common across all faculties)</i>	Field Work / Project/Internship/ OJT/ Apprenticeship / Case Study <b>Or</b> Co-curricular Courses (CCC) <b>(Basket 6 for CCC)</b> <i>(Common across all faculties)</i>	Credits	Total Credits
1	2	3	4	5	6	7	8	9	10	11
1 (4.5)	I	<b>SBOTCT1101</b> (T 2Cr) <b>SBOTCP1101</b> (P 2Cr) 4 Credits	<b>SZOOCT1101</b> (T 2Cr) <b>SZOOCP1101</b> (P 2Cr) 4 Credits	<b>SCHECT1101</b> (T 2Cr) <b>SCHECP1101</b> (P 2Cr) 4 Credits	<b>SBOTGE1101</b> (2cr)	<b>SBOTSC1101</b> 2 Credits	<b>AECENG1101</b> (2Cr) <b>ACEMIL1101</b> <b>(MAR/HIN/URD /KAN/PAL)</b> (2Cr) <b>IKSXXX1101</b> (2Cr) 6 Credits		22	44
	II	<b>SBOTCT1151</b> (T 2Cr) <b>SBOTCP1151</b> (P 2Cr) 4 Credits	<b>SZOOCT1151</b> (T 2Cr) <b>SZOOCP1151</b> (P 2Cr) 4 Credits	<b>SCHECT1151</b> (T 2Cr) <b>SCHECP1151</b> (P 2Cr) 4 Credits	<b>SBOTGE1151</b> (2cr)	<b>SBOTSC1151</b> 2 Credits	<b>AECENG1101</b> (2Cr) <b>ACEMIL1151</b> <b>(MAR/HIN/URD /KAN/PAL)</b> (2Cr) <b>VECCOI1151</b> (2Cr) <i>Constitution of India</i> 6 Credits		22	
	Cum. Cr.	<b>08</b>	<b>08</b>	<b>08</b>	<b>04</b>	<b>04</b>	<b>12</b>	<b>-</b>	<b>44</b>	
<p align="center"><b>Exit option:</b> UG Certificate in Opt 1, Opt 2 and Opt 3 on completion of 44 credits and additional 4 credits from NSQF / Internship</p>										



2 (5.0)	III	SBOTCT1201 (2cr) SBOTCT1202 (2cr) SBOTCP1201 (2cr) SBOTCP1202 (2cr) 8 Credits	SZOOMT1201 SZOOMP1201 (1T+1P) 2 Credits		SBOTGE1201 (2cr)	SBOTSC1201 2 Credits	ACEENG1201 (2cr) ACEMIL1201 (2Cr) (MAR/HIN/URD /KAN/PAL) 4 Credits	SBOTFP1201 (2Cr) CCCXXX1201 (2Cr) (NCC/NSS/SPT(sports)/ CLS(Cultural Studies)/HWS(Health Wellness)/ YGE(Yoga Education) / FIT(Fitness) 4Credits	22	88
	IV	SBOTCT1251 (2cr) SBOTCT1252 (2cr) SBOTCP1251 (2cr) SBOTCP1252 (2cr) 8 Credits	SZOOMT1251 SZOOMP1251 (1T+1P) 2 Credits		SBOTGE1251 (2cr)	SBOTVC1251 2 Credits	ACEENG1201 (2cr) ACEMIL1201 (2Cr) (MAR/HIN/URD /KAN/PAL) VECEVS1251 (2Cr) 6 Credits	CCCXXX1251 (2Cr) (NCC/NSS/SPT (sports)/ CLS(Cultural Studies)/HWS(Health Wellness)/ YGE(Yoga Education) / FIT(Fitness) 2 Credits	22	
	Cum. Cr.	24	12	08	08	08	22	06	88	88
<p><b>Exit option: UG Diploma in Major <u>DSC</u> and Minor <u>DSM</u> on completion of 88 credits and additional 4 credits NSQF / internship in DSC</b></p>										
3 (5.5)	V	SBOTCT1301 (T 3Cr) SBOTCT1302 (T 3Cr) SBOTIK1303 (T 2Cr) SBOTCP1301 (P 2Cr) SBOTCP1302 (P 2Cr) 12 Credits	SBOTET1301 (T 3Cr) SBOTEP1301 (P 1Cr) 4 Cr	--	--	SBOTVC1301 4 Credits	--	SBOTFP1301 (2 Cr) 2 Credits	22	132
	VI	SBOTCT1351 (T 3Cr) SBOTCT1352 (T 3Cr) SBOTCT1353 (T 2Cr) SBOTCP1351 (P 2Cr) SBOTCP1352 (P 2Cr) 12 Credits	SBOTET1351 (T 3Cr) SBOTEP1352 (P 1Cr) 4 Cr	--	--	SBOTVC1351 2 Credits	--	SBOTOJ1351 4 Credits	22	
	Cum. Cr.	56	12	08	08	6 + 8 =14	22	04+08	132	132

<b>Exit option: B. Sc. (Bachelor in Science) with Major in <u>DSC</u> and Minor in <u>DSM</u></b>										
<b>4 (6.0)</b>	<b>VII</b>	SBOTCT1401 (T 3Cr) SBOTCT1402 (T 3Cr) SBOTCT1403 (T 3Cr) SBOTCP1401 (P 2Cr) SBOTCP1402 (P 2Cr) SBOTCP1403 (P 1Cr) <b>14 Credits</b>	SBOTET1401 (T 3Cr) SBOTEP1401 (P 1Cr) <b>4 Cr</b>	Research Methodology SBOTRM1401 <b>4 Credits</b>		--	--	--	--	<b>22</b>
	<b>VIII</b>	SBOTCT1451 (T 3Cr) SBOTCT1452 (T 3Cr) SBOTCT1453 (T 3Cr) SBOTCP1451 (P 2Cr) SBOTCP1452 (P 2Cr) SBOTCP1453 (P 1Cr) <b>14 Credits</b>	SBOTET1401 (T 3Cr) SBOTEP1401 (P 1Cr) <b>4 Cr</b>	--		--	--	--	SBOTOJ1451 <b>4 Credits</b>	<b>22</b>
	<b>Cum Cr</b>	<b>Honours: 92</b>		<b>12+4</b>	<b>08</b>	<b>08</b>	<b>V-08 + S-06</b>	<b>AEC-8+MIL-8 +VEC-4 +IKS-2</b>	<b>16</b>	<b>176</b>
<b>Exit option: B. Sc. (Hons) with Major in <u>DSC</u> and Minor in <u>DSM</u></b>										
<b>4 (6.0)</b>	<b>VII</b>	SBOTCH1401 (T 3Cr) SBOTCH1402 (T 3Cr) SBOTCH1401 (P 2Cr) SBOTCH1402 (P 2Cr) <b>(H- Honours) 10 Credits</b>	SBOTET1401 (T 3Cr) SBOTEP1402 (P 1Cr) <b>4 Cr</b>	Research Methodology SBOTRM1401 <b>4 Credits</b>		--	--	--	Research Project SBOTRP1401 <b>4 Credits</b>	<b>22</b>
	<b>VIII</b>	SBOTCH1451 (T 3Cr) SBOTCH1452 (T 3Cr) SBOTCH1451 (P 2Cr) SBOTCH1452 (P 2Cr) <b>(H- Honours) 10 Credits</b>	SBOTET1451 (T 3Cr) SBOTEP1452 (P 1Cr) <b>4 Cr</b>	--		--	--	--	Research Project SBOTRP1451 <b>8 Credits</b>	<b>22</b>
<b>Exit option: B. Sc. (Hons with Research) in <u>DSC</u> and Minor in <u>DSM</u></b>										

<b>Total Credits</b>	<b>Major – 92 / 84</b>	<b>Minor 1 -12 + RM - 04</b>	<b>Minor 2- 08</b>	<b>GE/OE - 08</b>	<b>(V-08 + S-06) 14</b>	<b>(AEC-8 + MIL-8+VEC-4 + IKS-2)22</b>	<b>(CC-04+FP/CS-04+OJT-04+RP-12) 30</b>	<b>176</b>
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**Abbreviations:**

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| 1. <b>DSC:</b> Department/Discipline Specific Core (Major)     | 10. <b>MIL:</b> Modern Indian languages                      |
| 2. <b>DSE:</b> Department/Discipline Specific Elective (Major) | 11. <b>IKS:</b> Indian Knowledge System                      |
| 3. <b>DSM:</b> Discipline Specific Minor                       | 12. <b>VEC:</b> Value Education Courses                      |
| 4. <b>GE/OE:</b> Generic/Open Elective                         | 13. <b>OJT:</b> On Job Training: (Internship/Apprenticeship) |
| 5. <b>VSEC:</b> Vocational Skill and Skill Enhancement Course  | 14. <b>FP:</b> Field Projects                                |
| 6. <b>VSC:</b> Vocational Skill Courses                        | 15. <b>CEP:</b> Community Engagement and Service             |
| 7. <b>SEC:</b> Skill Enhancement Courses                       | 16. <b>CC:</b> Co-Curricular Courses                         |
| 8. <b>AEC:</b> Ability Enhancement courses                     | 17. <b>RM:</b> Research Methodology                          |
| 9. <b>RP:</b> Research Project/Dissertation                    |  |



## B. Sc. First Year Semester I (Level 4.5 )

### Teaching Scheme

	Course Code	CourseName	CreditsAssigned			TeachingScheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
<b>Optional 1</b>	SBOTCT1101	Viruses, Bacteria and Algae	02	--	<b>04</b>	02	--
	SBOTCP1101	Practical Based on SBOTCT 1101	-	02			04
<b>Optional 2</b>	SZOOCT1101	Optional 2	02	--	<b>04</b>	02	--
	SZOOCP1101	Optional 2	-	02			04
<b>Optional 3</b>	SCHECT1101	Optional 3	02	--	<b>04</b>	02	--
	SCHECP1101	Optional 3	-	02			04
<b>Generic Electives</b> <i>(from other Faculty)</i>	SBOTGE1101	Medicinal Plants and their Uses-I <b>(Basket 3)</b>	02	--	<b>02</b>	02	--
<b>Skill Based Course</b> <i>(related to Major)</i>	SBOTSC1101	<i>Trichoderma</i> cultivation <b>Technique</b>	--	02	<b>02</b>	--	04
<b>Ability Enhancement Course</b>	AECENG1101	L1 – Compulsory English	02	--	<b>02</b>	02	--
<b>Ability Enhancement Course</b>	ACEML1101	(MAR/HIN/URD /KAN/PAL)	02	--	<b>02</b>	02	--
<b>Indian Knowledge System (IKS)</b>	IKSXXX1101	Select from <b>Basket 5</b>	02	--	<b>02</b>	02	--
<b>Total Credits</b>			<b>14</b>	<b>08</b>	<b>22</b>	<b>14</b>	<b>16</b>



## B. Sc. First Year Semester I (Level 4.5 )

### Examination Scheme

[20% Continuous Assessment (CA) and 80% End Semester Assessment (ESA)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject (1)	Course Code (2)	CourseName (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA	CA (8)	ESA (9)	
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	Total (7)			
Optional 1	SBOTCT1101	Viruses, Bacteria and Algae	10	10	10	40	--	--	50
	SBOTCP1101	Practical Based on SBOTCT 1101	--	--	--	--	20	30	50
Optional 2	SZOOCT1101	Optional 2	10	10	10	40	--	--	50
	SZOOC1101	Optional 2	--	--	--	--	20	30	50
Optional 3	SCHECT1101	Optional 3	10	10	10	40	--	--	50
	SCHECP1101	Optional 3	--	--	--	--	20	30	50
Generic Elective	SBOTGE1101	Medicinal Plants and their Uses-I (Basket 3)	10	10	10	40	--	--	50
Skill Based Course	SBOTSC1101	Trichoderma cultivation Technique	--	--	--	--	20	30	50
Ability Enhancement Course	AECENG1101	L1 – Compulsory English	10	10	10	40	--	--	50
Ability Enhancement Course	ACEMIL1101	(MAR/HIN/URD /KAN/PAL)	10	10	10	40	--	--	50
Indian Knowledge System	IKSXXX1101	Select from Basket 5	10	10	10	40	--	--	50



## B. Sc. First Year Semester II (Level 4.5 )

### Teaching Scheme

	Course Code	CourseName	CreditsAssigned			TeachingScheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
<b>Optional 1</b>	SBOTCT1151	Fungi, Lichens and Mycorrhiza	02	--	<b>04</b>	02	--
	SBOTCP1151	Practical Based on SBOTCT 1151	-	02			04
<b>Optional 2</b>	SZOOCT1151	Optional 2	02	--	<b>04</b>	02	--
	SZOOC1151	Optional 2	-	02			04
<b>Optional 3</b>	SCHECT1151	Optional 3	02	--	<b>04</b>	02	--
	SCHECP1151	Optional 3	-	02			04
<b>Generic Electives</b> <i>(from other Faculty)</i>	SBOTGE1151	Medicinal Plants and their Uses-II <b>Basket 3</b>	02	--	<b>02</b>	02	--
<b>Skill Based Course</b> <i>(related to Major)</i>	SBOTSC1151	Mushroom cultivation Technique	--	02	<b>02</b>	--	04
<b>Ability Enhancement Course</b>	AECENG1151	L1 – Compulsory English	02	--	<b>02</b>	02	--
<b>Ability Enhancement Course</b>	ACEMIL1151	(MAR/HIN/URD /KAN/PAL)	02		<b>02</b>	02	
<b>Value Education Courses</b>	VECCOI1151	Constitution of India	02	--	<b>02</b>	02	--
<b>Total Credits</b>			<b>14</b>	<b>08</b>	<b>22</b>	<b>14</b>	<b>16</b>



## B. Sc. First Year Semester II (Level 4.5 )

### Examination Scheme

[20% Continuous Assessment (CA) and 80% End Semester Assessment (ESA)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject (1)	Course Code (2)	CourseName (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA	CA (8)	ESA (9)	
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	Total (7)			
Optional 1	SBOTCT1151	Fungi, Lichens and Mycorrhiza	10	10	10	40	--	--	50
	SBOTCP1151	Practical Based on SBOTCT 1151	--	--	--	--	20	30	50
Optional 2	SZOOCT1151	Optional 2	10	10	10	40	--	--	50
	SZOOC1151	Optional 2	--	--	--	--	20	30	50
Optional 3	SCHECT1151	Optional 3	10	10	10	40	--	--	50
	SCHECP1151	Optional 3	--	--	--	--	20	30	50
Generic Elective	SBOTGE1151	Medicinal Plants and their Uses-II <b>Basket 3</b>	10	10	10	40	--	--	50
Skill Based Course	SBOTSC1151	Mushroom cultivation Technique	--	--	--	--	20	30	50
Ability Enhancement Course	AECENG1151	L1 – Compulsory English	10	10	10	40	--	--	50
Ability Enhancement Course	ACEMIL1151	(MAR/HIN/URD /KAN/PAL)	10	10	10	40	--	--	50
Value Education Courses	VECCOI1151	Constitution of India	10	10	10	40	--	--	50

**Syllabus for B. Sc. Botany, First Year**  
**Semester – I**  
**As Per National Education Policy- 2020**

**To be Implemented from**  
**Academic Year 2024-2025**



**National Education Policy 2020**  
**B.Sc. Botany, I Year (Semester - I)**  
**Major Core Theory Course**  
**Course Code – SBOTCT 1101**  
**Title of the Course: VIRUSES, BACTERIA AND ALGAE**

[No. of Credits: 2 Credit]

[Total: 30 Hours]

**Course pre-requisite:**

1. The course is offered for a student registered for undergraduate programme in the Faculty of Science and Technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in Botany as Major subject.
2. The students should have basic knowledge of plant science.

**Course objectives:**

1. To study and impart knowledge about the occurrence, distribution, structure and life history of Viruses, Bacteria and Algae.
2. To instil in students an appreciation for the diversity of life forms and structural organization that exists within plant bodies that allow plants to develop and live as integrated organisms in diverse environments.

**Course outcomes:**

1. The students understand the morphology, structure, and evolution of various organisms like Viruses, Bacteria and Algae.
2. The students are able to differentiate between various groups of Viruses, Bacteria and Algae.
3. The students learn the importance of Viruses, Bacteria and Algae for human beings.

**CURRICULUM DETAILS: SBOTCT 1101: VIRUSES, BACTERIA AND ALGAE**

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
<b>1.0</b>		<b>VIRUSES</b>	
	<b>1.1</b>	Viruses –Introduction, brief history and general characters of viruses.	<b>07</b>
	<b>1.2</b>	Classification of Viruses (on the basis of Host). A general introduction with special reference to the structure of the TMV, T4 and $\lambda$ phage, viroids and prions.	
	<b>1.3</b>	Transmission of Viruses; Economic importance of Viruses	
	<b>1.4</b>	Study of Yellow Vein Mosaic of Bhendi	
<b>2.0</b>		<b>BACTERIA</b>	
	<b>2.1</b>	Bacteria – Introduction, General characters and classification. General characteristics, types of mycoplasma.	<b>08</b>
	<b>2.2</b>	Forms of Bacteria, Ultrastructure of Bacterial Cell and Flagellation.	
	<b>2.3</b>	Reproduction in Bacteria – asexual and sexual reproduction.	

	<b>2.4</b>	Economic importance of Bacteria. Study of Citrus Canker Disease. Economic importance of Mycoplasma: Little leaf of Brinjal and Leaf curl of papaya.	
<b>3.0</b>		<b>ALGAE-I</b>	
	<b>3.1</b>	Introduction, General characters.	<b>07</b>
	<b>3.2</b>	Classification of algae (F. E. Fritch's 1935).	
	<b>3.3</b>	Range of thallus organization and reproduction in algae	
	<b>3.4</b>	Systematic position, occurrence, thallus structure, reproduction and graphic life cycle of <i>Nostoc</i> and <i>Anabaena</i> .	
<b>4.0</b>		<b>ALGAE-II</b>	
	<b>4.1</b>	Systematic position, occurrence, thallus structure, reproduction and graphic life cycle of <i>Oedogonium</i>	<b>08</b>
	<b>4.2</b>	Systematic position, occurrence, thallus structure, reproduction and graphic life cycle of <i>Ectocarpus</i>	
	<b>4.3</b>	Systematic position, occurrence, thallus structure, reproduction and graphic life cycle of <i>Batrachospermum</i> and <i>Chara</i> .	
	<b>4.4</b>	Applications of Algae in agriculture, industry, environment and food.	
		<b>Total</b>	<b>30</b>

**Text Books and Reference Books:**

1. Vashishta B. R., Sinha A.K. and Singh V. P. (2014). Botany for Degree Students – Algae. S. Chand and Co.Ltd., New Delhi.
2. James Graham – Lee W. Wilcox - Linda E. Graham (2008). Algae (2nd edition)
3. Kumar, H. D. (1989). Introductory Phycology. East-West Press, Madras.
4. Round, F. E. (1981). The Ecology of Algae. Cambridge University Press, London.
5. Power and Dagainwala (1994). General Microbiology. Himalayan Publishing House, Bombay.
6. Mehrota, R. S. (1994). Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., Delhi.
7. Pandey, B. P. (1982). A Textbook of Plant Pathology, Pathogen and Plant Diseases. S.Chand and Co. Ltd., New Delhi.
8. Dubey, R. C. and Maheshwari, D. K. (2007). A Textbook of Microbiology. S. Chand and Co. Ltd., New Delhi.
9. Sharma, P. D. (1992). Microbiology. Rastogi & Co., Meerut.
10. Staley, J. T. *et al.* (1991). Bergey's Manual of Systematic Bacteriology. Vol. I to IV. Williams & Wilkins, London.
11. Davis, B. D., Dulbecco, R., Eiser, H. N. and Grinsberg, H. S. (1980). Microbiology. Harper & Row, New York.
12. Cooper, J. I. (1995). Viruses and the Environment. 2nd ed. Chapman & Hall, London.
13. Singh, R. S. (1990). Plant Diseases. 6th ed., Oxford & IBH, New Delhi.
14. Rangaswamy, G. (1972) Diseases of Crop Plants in India. Prentice Hall of India P Ltd.
15. Smith, K. M. (1957). A Textbook of Plant Virus Diseases. Little Brown & Co., Boston.
16. Walker, J. C. (1952). Diseases of Vegetable Crops. McGraw Hill Book Co. Inc., NY
17. Butler, E. J. and Jones, S. G. (1949). Plant Pathology. Macmillan & Co., London.
18. Bendre and Kumar (1997). A Textbook of Practical Botany, Vol I., Rastogi Publications, Meerut.
19. Pandey B. P. (2019) Modern Practical Botany Vol. I, S. Chand and Company.

**National Education Policy 2020**  
**B.Sc. Botany, I Year (Semester - I)**  
**Major Practical Course**  
**Course Code – SBOTCP 1101**  
**Title of the Course: Practical based on SBOTCT 1101**

[No. of Credits: 2 Credit]

[Total: 60 Hours]

**Course pre-requisite:**

1. The course is offered for a student registered for undergraduate programme in the Faculty of Science and Technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in Botany as Major subject.
2. The students should have basic knowledge of plant science.

**Course objectives:**

1. To develop skill and technique among the students for handling microscope and different instruments in the Botany lab.
2. To study and impart knowledge about the occurrence, distribution, structure and life history Viruses, Bacteria and Algae.
3. To understand the interdependence of life forms by forming symbiotic associations.

**Course outcomes:**

1. Students develop skill and technique for handling microscope and different instruments in the Botany lab.
2. The students understand the morphology, structure, and interdependence of various organisms like Viruses, Bacteria and Algae.
3. The students learn the importance of Viruses, Bacteria and Algae for human beings.

**CURRICULUM DETAILS: SBOTCP 1101: Practical based on SBOTCT 1101**

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Preparation of Gram Stain.	4
2.	Study of morphology of Bacteria by Gram staining method.	4
3.	Study of Asexual reproduction in Bacteria (By using visual Charts or slides).	4
4.	Study of sexual reproduction in Bacteria (By using visual Charts or slides).	4
5.	Study of citrus canker disease.	4
6.	Study of symptoms of yellow vein mosaic of Bhendi.	4
7.	Study of symptoms of Little leaf of Brinjal and Leaf curl of papaya.	4
8.	Identification, classification and description external and Internal structure of the <i>Nostoc</i> .	4
9.	Identification, classification and description external and Internal structure of the <i>Anabaena</i> .	4

10.	Identification, classification and description external and Internal structure of the <i>Oedogonium</i> .	4
11.	Identification, classification and description external and Internal structure of the <i>Ectocarpus</i> .	4
12.	Identification, classification and description external and Internal structure of the <i>Batrachospermu</i> .	4
13.	Identification, classification and description external and Internal structure of the <i>Chara</i> .	4
14.	Excursion/ study tour for specimen collection of Algae	4
15.	Excursion/ study long tour.	4
	<b>Total</b>	<b>60</b>

### ***Text Books and Reference Books:***

1. Vashishta B. R. ,Sinha A.K. and Singh V. P. (2014). Botany for Degree Students – Algae. S. Chand and Co.Ltd., New Delhi.
2. Davis, B. D., Dulbecco, R., Eiser, H. N. and Grinsberg, H. S. (1980). Microbiology.Harper & Row, New York.
3. Carpenter, P. L. (1967). Microbiology. Saunders Co., Philadelphia, USA.
4. Cooper, J. I. (1995). Viruses and the Environment. 2nd ed. Chapman & Hall, London.
5. Bilgrami, K. S. and Dube, H. C. (1990). A Textbook of Modern Plant Pathology. VikasPublishing House Pvt. Ltd., New Delhi.
6. Singh, R. S. (1990). Plant Diseases. 6th ed., Oxford & IBH, New Delhi.
7. Rangaswamy, G. and Soumini Rajagopalan. (1973). Bacterial Plant Pathology. TamilNadu Agricultural University, Coimbatore.
8. Rangaswamy, G.(1972) Diseases of Crop Plants in India. Prentice Hall of India P Ltd.
9. Smith, K. M. (1957). A Textbook of Plant Virus Diseases. Little Borwn& Co., Boston.
10. Walker, J. C. (1952). Diseases of Vegetable Crops. McGraw Hill Book Co. Inc., NY
11. Bendre and Kumar (1997). A Textbook of Practical Botany, Vol I., Rastogi Publications, Meerut.
12. Bendre and Kumar (1997). A Textbook of Practical Botany, Vol II., Rastogi Publications, Meerut.
13. Pandey B. P. (2019) Modern Practical Botany Vol. I, S. Chand and Company.
14. Pandey B. P. (2019) Modern Practical Botany Vol. II, S. Chand and Company

**National Education Policy 2020**  
**B.Sc. Botany, I Year (Semester - I)**  
**Generic Elective Course**  
**Course Code – SBOTGE 1101**

**Title of the Course: MEDICINAL PLANTS AND THEIR USES-I**

**[No. of Credits: 2 Credit]**

**[Total: 30 Hours]**

**Course pre-requisite:**

1. The course is offered for a student registered for undergraduate programme in the Faculty of Science and Technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in Botany as Major subject.
2. The students should have basic knowledge of plant science.

**Course objectives:**

1. To make the students aware of various herbal plants that can be grown in their area, be able to identify different plants and understand the economical and medicinal uses of these plants.
2. To develop the creativity of student by research and education in this aspect and reinforce the message of protection and care for the plants.

**Course outcomes:**

1. Understand history, Scope and Importance of Medicinal Plants & indigenous Medicinal Sciences
2. Describe the common medicinal plants in the neighbourhood for therapeutical use.
3. Conserve endangered and endemic medicinal plants.
4. Efficient in modern tool use to get additional knowledge from the internet.

**CURRICULUM DETAILS: SBOTGE 1101: MEDICINAL PLANTS AND THEIR USES-I**

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
<b>1.0</b>		<b>MEDICINAL PLANTS: INTRODUCTION</b>	
	<b>1.1</b>	Medicinal plants: definition, history, importance and future prospects.	<b>08</b>
	<b>1.2</b>	Medicinal Plants – past and present status in India.	
	<b>1.3</b>	Medicinal plant conservation – issues and approaches.	
	<b>1.4</b>	Traditional System of Medicine (TSM) in India. Introduction, Concept and Principles of Ayurveda, Siddha, Unani and, Homeopathy;	
<b>2.0</b>		<b>IMPORTANT MEDICINAL PLANTS OF MARATHWADA-I</b>	
	<b>2.1</b>	Systematics, distribution and medicinal uses: Tulsi( <i>Ocimum</i> sp),Pudina (( <i>Mentha</i> sp)	<b>07</b>
	<b>2.2</b>	Systematics, distribution and medicinal uses: Neem( <i>Azadirachta</i> sp), Gulvel ( <i>Tinospora</i> sp)	

	2.3	Systematics, distribution and medicinal uses: Adulsa ( <i>Adhatoda</i> sp), Kadechirayat ( <i>Andrographis</i> sp)	
	2.4	Systematics, distribution and medicinal uses:Nirgudi ( <i>Vitex</i> sp)	
<b>3.0</b>		<b>IMPORTANT MEDICINAL PLANTS OF MARATHWADA-II</b>	
	3.1	Systematics, distribution and medicinal uses: Shatavari ( <i>Asparagus</i> sp), <i>Aloe</i> sp.	<b>07</b>
	3.2	Systematics, distribution and medicinal uses: Turmeric ( <i>Curcuma</i> sp, Ginger ( <i>Zingiber</i> sp)	
	3.3	Systematics, distribution and medicinal uses: Panfuti ( <i>Bryophyllum</i> sp), Jakhamjodi ( <i>Tridax</i> sp)	
	3.4	Systematics, distribution and medicinal uses: Shevga ( <i>Moringa</i> sp)	
<b>4.0</b>		<b>IMPORTANT MEDICINAL PLANTS OF MARATHWADA-III</b>	
	4.1	Systematics, distribution and medicinal uses: Hirda( <i>Terminaliachebula</i> ), Behda ( <i>Terminaliabelerica</i> )	<b>08</b>
	4.2	Systematics, distribution and medicinal uses: Awala ( <i>Phyllanthes</i> sp); Lemon ( <i>Citruss</i> sp)	
	4.3	Systematics, distribution and medicinal uses: Ashwagandha ( <i>Withania</i> sp).	
	4.4	Systematics, distribution and medicinal uses: Gudmar( <i>Gymnema</i> sp).	

### ***Text Books and Reference Books:***

1. Medicinal Plants of Indian Himalaya by S.S. Samant and U. Dha.
2. Medicinal Plants by P.C. Trivedi (2009).
3. Handbook of Medicinal and Aromatic Plants by S.K. Bhattacharjee (2004).
4. Recent Progress in Medicinal Plants Vol.12, Globalization of Herbal Health by A.K. Sharma
5. (2006).
6. Handbook of Ayurvedic Medicinal Plants by L.D. Kapoor (2005).
7. Indian Medicinal Plants (Vol 1- 4) by K.R. Kirtikar and B.D. Basu (2006).
8. Glossary of Medicinal Plants Used in Ayurveda by Amrutpal Singh Saroya (2006).
9. Indigenous Medicinal Plants Social Forestry & Tribals by M.P. Singh et al. (2003).
10. Ayurvedic Drugs and their Plant Sources by V.V. Sivarajan & I. Balachandran, Oxford &
11. IBH (1994).
12. 10.The Handbook of Ayurveda Shantha by Godagama, Bishen Singh Mahendrpal Singh, Dehradun (2004).

**National Education Policy 2020**  
**B.Sc. Botany, I Year (Semester - I)**  
**Skill Enhancement Course**  
**Course Code – SBOTSC1101**

**Title of the Course: TRICHODERMA CULTIVATION TECHNIQUE**

**[No. of Credits: 2 Credit]**

**[Total: 60 Hours]**

**Course pre-requisite:**

1. The course is offered for a student registered for undergraduate programme in the Faculty of Science and Technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in Botany as Major subject.
2. The students should have basic knowledge of plant science.

**Course objectives:**

1. To inculcate concepts of *Trichoderma*.
2. To understand techniques in *Trichoderma* technology.
3. To increase employability of the students.
4. To improve the soil quality by promoting the biofertilizers.

**Course outcomes:**

1. Understanding the role of organic farming.
2. Understanding the potential of *Trichoderma* as an alternative to chemical fertilizers
3. Role of *Trichoderma* in protecting the environment and managing the waste.

**CURRICULUM DETAILS: SBOTSC 1101: TRICHODERMA CULTIVATION TECHNIQUE**

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Introduction of biocontrol	4
	<i>Trichoderma</i> : introduction, systematic position and thallus structure of	
2.	Cultivation details of <i>Trichoderma</i>	4
3.	<i>Trichoderma</i> as biopesticides, biofertilizers	4
4.	<i>Trichoderma</i> as growth stimulating agent and in management of agricultural wastes	4
5.	Characteristics of <i>Trichoderma</i> for formulation development	4
6.	Formulation development	4
7.	Model methods for the mass multiplication of <i>Trichoderma</i>	4
8.	Shelf life of <i>Trichoderma</i> formulations	4
9.	Improvement of formulation efficacy	4

10.	Delivery of <i>Trichoderma</i> for disease management: seed treatment, seed biopriming, soil treatment, root treatment, etc	4
11.	Commercial products of bio-control agents	4
12.	Commercialization of <i>Trichoderma</i> as biocontrol agent	4
13.	Constraints to commercialization	4
14.	Strategies to promote commercialization	4
15.	Visit to a <i>Trichoderma</i> cultivation laboratory in nearby area	4
	<b>Total</b>	<b>60</b>

### ***Text Books and Reference Books:***

1. Anil K Sharma and Pratibha Sharma (2020) *Trichoderma- Host Pathogen Interactions and Applications*, Springer.
2. Singh, Archana U & S P Tiwari (2021) *Trichoderma Research and Development* , Today & Tomorrows Printers and Publishers
3. Krishnendu Acharya , Surjit Sen and Manjula Rai (2019) *Biofertilizers and Biopesticides*, Techno World.
4. Harmon GE, Bjoorman T (1998), Potential and existing uses of *Trichoderma* and *Gliocladium* for plant disease control and plant growth enhancement . In : *Trichoderma and Gliocladium* , vol. II. G.E. Harman and C.K. Kubicek, (Eds), 229, London: Taylor and Francis Ltd. <http://dx.doi.org/10.1099/mic.0.052274-0>
5. Jeyarajan R, Nakkeeran S (2000). Exploitation of microorganisms and viruses as biocontrol agents for crop disease mangement. *In: Biocontrol Potential and their Exploitation in Sustainable agriculture*,(Ed. Upadhyay et al.,) Kluwer Academic/ Plenum Publishers, USA pp. 95-116. [http://dx.doi.org/10.1007/978-1-4615-4209-4\\_8](http://dx.doi.org/10.1007/978-1-4615-4209-4_8)
6. Jeyarajan R, Ramakrishnan G, Dinakaran D, Sridar R (1994). Development of products of *Trichoderma viride* and *Bacillus subtilis* for biocontrol of root rot diseases. In “Biotechnology in India” (Ed Dwivedi B.K.) Bioved Research Society, Allahabad. pp. 25-36.
7. Jeyarajan R (2006). Prospects of indigenous mass production and formulation of *Trichroderma*, In *Current Status of Biological Control of Plant diseases using antagonistic organisms in India* (Eds Rabindra RJ Ramanujam B), Project Directorate of Biological Control, Bangalore, pp. 74-80, 445.



**Syllabus for B. Sc. Botany, First Year**  
**Semester – II**  
**As Per National Education Policy- 2020**

**To be Implemented from**  
**Academic Year 2024-2025**

National Education Policy 2020  
**B.Sc. Botany, I Year (Semester - II)**  
 Major Core Theory Course  
 Course Code – **SBOTCT 1151**  
 Title of the Course: **FUNGI, LICHENS AND MYCORRHIZA**

[No. of Credits: 2 Credit]

[Total: 30 Hours]

**Course pre-requisite:**

1. The course is offered for a student registered for undergraduate programme in the Faculty of Science and Technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in Botany as Major subject.
2. The students should have basic knowledge of plant science.

**Course objectives:**

1. To study and impart knowledge about the occurrence, distribution, structure and life history Fungi, Lichens and Mycoplasma.
2. To understand the interdependence of life forms by forming symbiotic associations.

**Course outcomes:**

1. The students understand the morphology, structure, and interdependence of various organisms like Fungi, Lichens and Mycorrhiza.
2. The students are able to differentiate between various groups of Fungi, Lichens and Mycoplasma.
3. The students learn the importance of Fungi, Lichens and Mycoplasma for human beings.

**CURRICULUM DETAILS: SBOTCT 1151: FUNGI, LICHENS AND MYCORRHIZA**

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
<b>1.0</b>		<b>FUNGI-I</b>	
	<b>1.1</b>	Introduction and General Characteristics of Fungi, Classification of Fungi (as per Alexopolous & Mims, 1979)	<b>07</b>
	<b>1.2</b>	Thallus organization, Cell wall composition, nutrition and reproduction in Fungi	
	<b>1.3</b>	Systematic position, occurrence, structure of mycelium, reproduction and graphic life cycle of <i>Albugo and Rhizopus</i> .	
	<b>1.4</b>	Systematic position, occurrence, structure of mycelium, reproduction and graphic life cycle of <i>Eurotium</i> .	
<b>2.0</b>		<b>FUNGI – II</b>	
	<b>2.1</b>	Systematic position, occurrence, structure of mycelium, reproduction and graphic life cycle of <i>Agaricus</i> .	<b>08</b>
	<b>2.2</b>	Systematic position, occurrence, structure of mycelium, reproduction and graphic life cycle of <i>Alternaria</i>	

	<b>2.3</b>	Economic Importance of Fungi: Leaf spot of tomato and White rust of Mustard.	
	<b>2.4</b>	Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Agriculture (Biofertilizers; Medical mycology. Mushroom cultivation.	
<b>3.0</b>		<b>LICHENS</b>	
	<b>3.1</b>	Lichens: Occurrence; General Characters.	<b>08</b>
	<b>3.2</b>	Classification of Lichens and Types of Lichens	
	<b>3.3</b>	Growth forms and range of thallus organization; Nature of associations of algal and fungal partners.	
	<b>3.4</b>	Economic importance of Lichens (Lichens as food, Bioremediation, Ecological indicators, Pollution indicators, Lichen in Soil formation)	
<b>4.0</b>		<b>MYCORRHIZA</b>	
	<b>4.1</b>	General Characters of mycorrhiza	<b>07</b>
	<b>4.2</b>	Classification of mycorrhiza	
	<b>4.3</b>	Types of mycorrhizae	
	<b>4.4</b>	Economic importance of mycorrhiza.	
		<b>Total</b>	<b>30</b>

### ***Text Books and Reference Books:***

1. Vashishta B. R. and Sinha A.K. (2014). Botany for Degree Students – Fungi. S. Chand and Co. Ltd., New Delhi.
2. R.M. Johri, Sneha Lata and Kavita Tyagi, (2011). A Textbook of Fungi.
3. C.S. Chandoliya (2009). Fungi: Biological Diversity Cyber Tech Pub.
4. John Webster and Roland Weber (2007). Introduction to Fungi.
5. Mehrotra, R. S and Aneja, K. R. (1990). An Introduction of Mycology. Wiley Eastern Ltd., New Delhi.
6. Hale, M. E. Jr. (1983). Biology of Lichens. Edward Arnold, Maryland.
7. Alexopoulos, C. J. and Mims, C. W. (1979). Introductory Mycology. Wiley Eastern Ltd., New York.
8. Pelczar, M. J., Chan, E. C. S. and Krieg, N. R. (1993). Microbiology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
9. Mehrotra, R. S. (1994). Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., Delhi.
10. Pandey, B. P. (1982). A Textbook of Plant Pathology, Pathogen and Plant Diseases. S. Chand and Co. Ltd., New Delhi.
11. Dubey, R. C. and Maheshwari, D. K. (2007). A Textbook of Microbiology. S. Chand and Co. Ltd., New Delhi.
12. Sharma, P. D. (1992). Microbiology. Rastogi & Co., Meerut.
13. Bilgrami, K. S. and Dube, H. C. (1990). A Textbook of Modern Plant Pathology. Vikas Publishing House Pvt. Ltd., New Delhi.
14. Singh, R. S. (1990). Plant Diseases. 6th ed., Oxford & IBH, New Delhi.
15. Rangaswamy, G. (1972) Diseases of Crop Plants in India. Prentice Hall of India P Ltd.
16. Walker, J. C. (1952). Diseases of Vegetable Crops. McGraw Hill Book Co. Inc., NY
17. Butler, E. J. and Jones, S. G. (1949). Plant Pathology. Macmillan & Co., London.
18. Bendre and Kumar (1997). A Textbook of Practical Botany, Vol I., Rastogi Publications, Meerut.
19. Pandey B. P. (2019) Modern Practical Botany Vol. I, S. Chand and Company.

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**National Education Policy 2020**  
**B.Sc. Botany, I Year (Semester -II)**  
**Major Practical Course**  
**Course Code – SBOTCP 1151**  
**Title of the Course: Practical based on SBOTCT 1151**

[No. of Credits: 2 Credit]

[Total: 60 Hours]

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**Course pre-requisite:**

1. The course is offered for a student registered for undergraduate programme in the Faculty of Science and Technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in Botany as Major subject.
2. The students should have basic knowledge of plant science.

**Course objectives:**

4. To develop skill and technique among the students for handling microscope and different instruments in the Botany lab.
5. To study and impart knowledge about the occurrence, distribution, structure and life history Viruses, Bacteria, Algae, Fungi, Lichens and Mycoplasma.
6. To understand the interdependence of life forms by forming symbiotic associations.

**Course outcomes:**

4. Students develop skill and technique for handling microscope and different instruments in the Botany lab.
5. The students understand the morphology, structure, and interdependence of various organisms like Viruses, Bacteria, Algae, Fungi, Lichens and Mycoplasma.
6. The students learn the importance of Fungi, Lichens and Mycoplasma for human beings.

**CURRICULUM DETAILS: SBOTCP 1151: Practical based on SBOTCT 1151**

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Preparation of Stains (Cotton blue, Lactophenol, Crystal violet, light green).	4
2.	Isolation and identification of fungi from Air.	4
3.	Isolation and identification of fungi from Soil by dilution plate technique.	4
4.	Isolation and identification of fungi from diseased plants.	4
5.	Study of Leaf spot of tomato and White rust of Mustard.	4
6.	<i>Albugo</i> : systematic position, external and internal features.	4
7.	<i>Rhizopus</i> : systematic position, external and internal features.	4
8.	<i>Eurotium</i> : systematic position, external and internal features.	4
9.	<i>Agaricus</i> : systematic position, external and internal features.	4

10.	<i>Alternaria</i> : systematic position, external and internal features.	4
11.	Study of different forms of Lichens.	4
12.	Study of ectomycorrhiza and endomycorrhiza.	4
13.	Industrial Visit	4
14.	Excursion/ study tour for specimen collection of Fungi	4
15.	Excursion/ study tour for specimen collection of lichens and mycorrhiza	4
	<b>Total</b>	<b>60</b>

### ***Text Books and Reference Books:***

15. Vashishta B. R. ,Sinha A.K. and Singh V. P. (2014). Botany for Degree Students – Algae. S. Chand and Co.Ltd., New Delhi.
16. Vashishta B. R. and Sinha A.K. (2014). Botany for Degree Students – Fungi. S. Chand and Co.Ltd., New Delhi.
17. Vashishta, B. R. *et al.* (2014). Botany for Degree Students – Bryophytes. S. Chand and Co.Ltd., New Delhi.
18. Davis, B. D., Dulbecco, R., Eiser, H. N. and Grinsberg, H. S. (1980). Microbiology. Harper & Row, New York.
19. Carpenter, P. L. (1967). Microbiology. Saunders Co., Philadelphia, USA.
20. Cooper, J. I. (1995). Viruses and the Environment. 2nd ed. Chapman & Hall, London.
21. Bilgrami, K. S. and Dube, H. C. (1990). A Textbook of Modern Plant Pathology. Vikas Publishing House Pvt. Ltd., New Delhi.
22. Singh, R. S. (1990). Plant Diseases. 6th ed., Oxford & IBH, New Delhi.
23. Rangaswamy, G. and Soumini Rajagopalan. (1973). Bacterial Plant Pathology. TamilNadu Agricultural University, Coimbatore.
24. Rangaswamy, G.(1972) Diseases of Crop Plants in India. Prentice Hall of India P Ltd.
25. Smith, K. M. (1957). A Textbook of Plant Virus Diseases. Little Borwn & Co., Boston.
26. Walker, J. C. (1952). Diseases of Vegetable Crops. McGraw Hill Book Co. Inc., NY
27. Butler, E. J. and Jones, S. G. (1949). Plant Pathology. Macmillan & Co., London.
28. Bendre and Kumar (1997). A Textbook of Practical Botany, Vol I., Rastogi Publications, Meerut.
29. Bendre and Kumar (1997). A Textbook of Practical Botany, Vol II., Rastogi Publications, Meerut.
30. Pandey B. P. (2019) Modern Practical Botany Vol. I, S. Chand and Company.

**National Education Policy 2020**  
**B.Sc. Botany, I Year (Semester - II)**  
**Generic Elective Course**  
**Course Code – SBOTGE 1151**

**Title of the Course: MEDICINAL PLANTS AND THEIR USES-II**

[No. of Credits: 2 Credit]

[Total: 30 Hours]

**Course pre-requisite:**

1. The course is offered for a student registered for undergraduate programme in the Faculty of Science and Technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in Botany as Major subject.
2. The students should have basic knowledge of plant science.

**Course objectives:**

1. To make the students aware of various herbal plants that can be grown in their area, be able to identify different plants and understand the economical and medicinal uses of these plants.
2. To develop the creativity of student by research and education in this aspect and reinforce the message of protection and care for the plants.

**Course outcomes:**

1. Understand history, Scope and Importance of Medicinal Plants & indigenous Medicinal Sciences
2. Describe the common medicinal plants in the neighbourhood for therapeutical use.
3. Conserve endangered and endemic medicinal plants.
4. Efficient in modern tool use to get additional knowledge from the internet.

**CURRICULUM DETAILS: SBOTGE 1151: MEDICINAL PLANTS AND THEIR USES-II**

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
<b>1.0</b>		<b>IMPORTANT MEDICINAL PLANTS-I</b>	
	<b>1.1</b>	Distribution and medicinal uses of: Gulvel ( <i>Tinisporas sp</i> ), Panfuti ( <i>Bryophyllum sp</i> )	<b>08</b>
	<b>1.2</b>	Distribution and medicinal uses of: Shatavari ( <i>Asparagus sp</i> )	
	<b>1.3</b>	Distribution and medicinal uses of: Bel ( <i>Aegle sp</i> ), Karwand ( <i>Carissa sp</i> )	
	<b>1.4</b>	Distribution and medicinal uses of: Kandvel ( <i>Cissus sp</i> )	
<b>2.0</b>		<b>IMPORTANT MEDICINAL PLANTS-II</b>	
	<b>2.1</b>	Distribution and medicinal uses of: Gawati chaha ( <i>Cymbopogon sp</i> ), Chamkura ( <i>Colocasia sp</i> )	<b>07</b>
	<b>2.2</b>	Distribution and medicinal uses of: Kattha ( <i>Acacia sp</i> )	
	<b>2.3</b>	Distribution and medicinal uses of: Sitafal ( <i>Annona sp</i> )	
	<b>2.4</b>	Distribution and medicinal uses of :Mehandi ( <i>Lawsomia sp</i> )	
<b>3.0</b>		<b>IMPORTANT MEDICINAL PLANTS-III</b>	
	<b>3.1</b>	Distribution and medicinal uses of : Kadhipatta ( <i>Myrayya sp</i> )	<b>08</b>

	<b>3.2</b>	Distribution and medicinal uses of : Kadechirayata ( <i>Andrographis sp</i> ), Ritha ( <i>Sapindus sp</i> ),	
	<b>3.3</b>	Distribution and medicinal uses of :Gudmar ( <i>Gymnema sp</i> )	
	<b>3.4</b>	Distribution and medicinal uses of :Jambhul ( <i>Sizijium sp</i> )	
<b>4.0</b>		<b>IMPORTANT MEDICINAL PLANTS-IV</b>	
	<b>4.1</b>	Distribution and medicinal uses of : Muradshend ( <i>Helicteres sp</i> ), Guggul ( <i>Commiphora sp</i> )	<b>07</b>
	<b>4.2</b>	Distribution and medicinal uses of : Umber ( <i>Ficus sp</i> )	
	<b>4.3</b>	Distribution and medicinal uses of : Kawath ( <i>Limonia asp</i> )	
	<b>4.4</b>	Distribution and medicinal uses of : Moha ( <i>Madhuca sp</i> )	
		<b>Total</b>	<b>30</b>

### ***Text Books and Reference Books:***

1. Medicinal Plants of Indian Himalaya by S.S. Samant and U. Dha.
2. Medicinal Plants by P.C. Trivedi (2009).
3. Handbook of Medicinal and Aromatic Plants by S.K. Bhattacharjee (2004).
4. Recent Progress in Medicinal Plants Vol.12, Globalization of Herbal Health by A.K. Sharma
5. (2006).
6. Handbook of Ayurvedic Medicinal Plants by L.D. Kapoor (2005).
7. Indian Medicinal Plants (Vol 1- 4) by K.R. Kirtikar and B.D. Basu (2006).
8. Glossary of Medicinal Plants Used in Ayurveda by Amrutpal Singh Saroya (2006).
9. Indigenous Medicinal Plants Social Forestry & Tribals by M.P. Singh et al. (2003).
10. Ayurvedic Drugs and their Plant Sources by V.V. Sivarajan & I. Balachandran, Oxford &
11. IBH (1994).
12. 10.The Handbook of Ayurveda Shantha by Godagama, Bishen Singh Mahendrapal Singh, Dehradun (2004).

**National Education Policy 2020**  
**B.Sc. Botany, I Year (Semester - II)**  
**Skill Enhancement Course**  
**Course Code – SBOTSC 1151**

**Title of the Course: MUSHROOM CULTIVATION TECHNIQUE**

**[No. of Credits: 2 Credit]**

**[Total: 30 Hours]**

**Course pre-requisite:**

1. The course is offered for a student registered for undergraduate programme in the Faculty of Science and Technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in Botany as Major subject.
2. The students should have basic knowledge of plant science.

**Course objectives:**

1. To inculcate concepts of Mushroom Cultivation.
2. To understand techniques in Mushroom Cultivation.
3. To increase employability of the students.

**Course outcomes:**

1. Students understand mushroom cultivation technique
2. Students understand the potential of mushroom cultivation as a source of food.
3. Students understand the potential of mushroom cultivation as a source of self-employment.

**CURRICULUM DETAILS: SBOTSC 1151: MUSHROOM CULTIVATION TECHNIQUE**

<b>Sr. No</b>	<b>Practical Exercises</b>	<b>Hrs. Required to cover the contents</b>
1.	Introduction of Mushrooms, Different parts of a typical mushroom & variations in mushroom morphology. & Hypogenous, Natural Habitats- Humicolous, Lignicolous & Coprophilous	4
2.	Key to differentiate Edible from Poisonous mushrooms. Based on occurrence- Epigenous	4
3.	Mushroom: Structure and texture of fruit bodies-gilled fungal & pore fungal	4
4.	Button, Straw & Oyster- General morphology, distinguishing characteristics, spore germination and life cycle.	4
5.	Mushroom: Protein, aminoacids, calorific values, carbohydrates, fats, vitamins & minerals.	4
6.	Mushroom Farm structure, Design and Layout: Mushroom Houses, Selection, layout and construction of Mushroom farm, construction of infrastructure, pasteurization chamber/ tunnel, casing pasteurization chamber, cropping rooms- lighting arrangements, spawn laboratory, Post harvesting unit.	4
7.	Spawn- Principles and Technique of spawn production: Kinds of spawn and material used, modern manufacture of spawn, preparation of spawn, storage	4



	and transportation of spawn, qualities of a good spawn.	
8.	principle and techniques of compost and composting process: Goals of composting, materials suitable for composting, methods of preparation of compost- long method of composting, short method of composting, machinery and other basic pre-requisites to the composting process, characteristics of good compost, characteristics of compost after phase I & before filling, indoor filling.	4
9.	Method of spawning: Mixed spawning, shake-up spawning, super spawning surface spawning, optimal quantity of spawn, casing- requirement & characteristics of good casing soils, casing spawned bags	4
10.	Study of Casing and Cropping	4
11.	Study of harvesting of mushroom.	4
12.	Study of preservation methods of mushroom.	4
13.	Cultivation of Oyster mushroom ( <i>Pleurotus sajor-caju</i> ): Composting, Spawning, Casing, Cropping, Harvesting, Preservation	4
14.	Cultivation of Button mushroom ( <i>Agaricus</i> ): Composting, Spawning, Casing, Cropping, Harvesting, Preservation	4
15.	Visit to Mushroom cultivation center.	4
	<b>Total</b>	<b>60</b>

### ***Text Books and Reference Books:***

1. Marimuthu, T. *et al* (1991). Oyster mushroom, Dept of plant pathology Tamil Nadu. Agriculture University, Coimbatore.
2. Pandey R. K, S. K Ghosh, 1996. A Handbook on mushroom cultivation. Emkey publication.
3. Panthak V. N & Yadav N. (1998). Mushroom production & processing technology AGROBIOS JAIPUR.
4. Nitha Bhal (2000). Handbook on mushroom 2nd. ed. vol.1 and 2. Oxford and IBH publication co. pvt ltd. New Delhi.
5. Tewari Pankaj Kapoor, S. C. (1988). Mushroom cultivation. Mittal publication, New Delhi.
6. V. Npathak, Nagendra Yadavu and Maneesha Gaur, Mushroom production and processing technology vedams Ebook PVT–Ltd NEW DELHI. (2008)
7. A hand book of edible mushroom, S.Kannaiyan & K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi
8. Handbook on Mushrooms, Nita Bahl, oxford & IBH Publishing Co
9. Mushroom Cultivation, Tripathi, D. P. (2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi.

## **Guidelines for the Course Assessment:**

### **A. Continuous Assessment (CA) (20% of the Maximum Marks) of theory and practical courses:**

- i. **For Theory Course:** CA shall form 20% of the Maximum Marks and shall be carried out over the entire semester. It shall be done by conducting **Two Tests** (Test I on 40% curriculum) and **Test II** (on remaining 40% syllabus) and average of the marks scored by a student in these two tests of a particular paper shall be taken as the **CA** score.
- ii. **For Practical Course:** CA score of the practical course shall be marks scored by a student in the internal practical examination conducted by the concerned teacher.

### **B. End Semester Assessment (80% of the Maximum Marks) of theory and practical courses:**

*(For illustration a paper of 02 credits, 50 marks has been considered and shall be modified appropriately depending upon credits of the individual paper)*

#### ***Question Paper Pattern of the ESA:***

- i. **ESA Question paper shall consist 6 questions, each of 10 marks**
- ii. **Question No.1 shall be compulsory and shall be based on the entire syllabus**
- iii. Students shall have to solve **ANY THREE** of the remaining Five Questions (i.e. from question 2 to 6)
- iv. **Students shall have to solve a TOTAL of 4 Questions.**

### **C. Assessment of On Job Training (OJT) Course (for 04 credits):**

- a. Continuous assessment part (**40%, 40 marks out of 100**) of this course shall be done by the mentor of the student, where he /she is supposed to complete his On Job Training. This shall be based on the regularity, participation and performance of the students at the place of OJT.
- b. Semester End Assessment (ESA) (**60% of the total marks, 60 marks out of 100**) of this course shall be done by a panel of examiners in two parts
  - i. based on the work report submitted by the student (**50% i.e. 30 marks**) and
  - ii. **Remaining 50%** (30 marks) shall be based on his presentation and viva-voce on the work carried to be assessed by the panel of examiners. This assessment shall be done along with practical examinations of respective courses / subjects.

### **D. Assessment of Field Project (FP) and Research Project (RP) (e.g. for 02 credits)**

- a. Continuous assessment part (**40%, 20 marks out of 50**) of this course shall be done by the mentor of the student and shall be based on regularity, experimental work and performance of the student.
- b. Semester End Assessment (ESA) (**60% of the total marks, 30 marks out of 50**) of this course shall be done shall be done by a panel of examiners in two parts
  - i. based on the work report submitted by the student (**50% i.e. 30 marks**) and
  - ii. **Remaining 50%** (30 marks) shall be based on his presentation and viva-voce on the work carried out by the student. This assessment shall be done along with practical examinations of the respective courses / subjects.

**E. Assessment of Co-Curricular courses (CCC):**

- a. Assessment of the CCC course shall be done by the respective course coordinator as a part of CA and be based on the regularity, performance of a student and his participation in various activities as prescribed in the regulations prepared in this regard.
- b. The End Semester Assessment (ESA) of the CCC courses shall be done as per the regulations prepared in this regard and shall be done on the basis of the write-up, presentation by the student on the activities that he has carried out in a semester.
- c. Students shall have freedom to opt for more than one CCC courses. However, score of the best performing CC shall be considered for preparing his result.

**F. Syllabi, Teaching and Examination Scheme for the courses in Column 7 and Column 8 (AEC, VEC, IKS, CI, EVS, CCCs, etc.) shall be common for all the students from different faculties.**

**Note: Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. One credit of theory corresponds to 15 Hours lecturing and for practical course one credit corresponds to 30 Hours. For example, for a course of two credits 30 lectures of one hour duration are assigned, while that for a three credit course 45 lectures.**

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