

**Sant Gadge Baba Amravati University, Amravati**

**Faculty: Science and Technology**

**Programme: B. Sc. Botany**

**POs:**

The students graduating with the degree B.Sc. with Botany will be able to

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

**PSOs:**

Upon completion of the programme successfully, students would be able to

1. Identify major groups of plants and compare the characteristics of lower ( microbes, algae ,fungi, bryophytes and pteridophytes) and higher ( Gymnosperms and angiosperms).
2. use evidence based comparative botany approach to explain the evolution of organism and understand the genetic diversity.
3. explain various plant processes and functions, metabolism, concepts of gene, genome and how organism's function is influenced at the cell, tissue and organ level.
4. understand adaptation, development and behavior of different forms of life.
5. demonstrate the experimental techniques and methods of their area of specialization in Botany.

**Employability Potential of the Programme:**

A career in botany can be one of the most preferred careers for the science graduate. The subject botany, which is related to the study of plants means studying about algae, fungi, diseases, higher plants, growth, metabolism and the structure among different groups. Job profile in botany includes study of plants, research, working with various industries, teaching, self-employment and many more fields.

Botany person is able to study plant life along with finding solutions to problems related to that of forest and agriculture. Botanist also deals with space travel agriculture, artificial environments, hydroponics and various other interesting areas of research.

Botany graduates and post graduates are required by various organizations ranging from local to multinationals to research organizations to hospitality and tourism industry depending upon their nature of activities. They fit into different roles depending upon nature of work and evolve into senior position at high salaries.

After graduation in botany, candidate can look forward to being a part of industry such as pesticide, fungicide, biofertilizer, food processing unit, pharmaceuticals etc. by working as a lab technician.

The amount of diversity in the field of botany gives liberty to student to choose specialization as per their own interest, choice and interest. Student can work in organization/ industry as a

- I. Plant explorer with special skill of writing, photography, passion in expedition etc.
- II. Conversationalist in organizations working for conservation of environment
- III. Ecologist
- IV. Environment consultant
- V. Agriculture consultant
- VI. Botanical Field technician
- VII. Green house operator
- VIII. Plant biochemist
- IX. Horticulturist
- X. Nursery manager
- XI. Taxonomist
- XII. Plant pathologist
- XIII. Farming consultant
- XIV. Molecular biologist

The numbers of professions for botanist are endless. More ever the applications of plant sciences improve the yield and supply of medicine, food fibers, building materials and other plant products. The knowledge

of plant sciences is essential for development and management of forests, parks, waste land, sea wealth etc. Few examples of industry with which botany student can work are

- Chemical industry
- Food industry
- Arboretum
- Forest services
- Botanical survey of India
- Biotechnology firms
- Oil industry
- Land management agencies
- Seed and Nursery companies
- Plant health inspection services
- National parks
- Biological supply houses
- Plant resources laboratory
- Educational institutions

The pay scale of botanist has wide diversity ranging from 15000 to 60000 and more per month depending upon job role and organization. Salary also varies in government and private sector. One can secure job through competitive exams in government sector such as forest services, biological survey of India, in teaching field, research assistant etc.

#### Future Prospectus

A student offering botany as a subject for his graduation has tremendous scope for his progression

- ❖ Botany student can opt for further study in number of esteemed institutions of national importance like IIT, IISER, ATREE, NIT, IISc, BARK, TIFR.
- ❖ After graduation student can opt for M Sc in various applied subject like Plant Breeding, Seed technology, genetic engineering, plant biotechnology etc. in addition to M Sc in botany
- ❖ One can establish his own industry
- ❖ Can opt entrepreneur as his career
- ❖ One Can make his career as administrative officer through state and union public service commission IFS, IAS, Range forest officer, drug inspector etc.
- ❖ Huge scope in research with prestigious institution like CCMB, TIFR, IIT, IISc etc.
- ❖ Student can opt teaching in Kendriya vidyalaya, Navodaya vidyalaya etc. by taking degree like B Ed or can crack National eligibility test or state eligibility test and become senior lecturer in higher education.

**Scheme of Teaching, Learning & Examination leading to the Degree in Bachelor of Science in the Programme Environmental Science  
(Three years- Six Semester Degree Programme- C.B.C.S.)  
(B.Sc. Part I) Semester I**

Sr.	Subject	Subject code	Teaching & Learning Scheme							Duration of Exam Hours	Examination & Evaluation Scheme						
			Teaching Periods Per Week				Credits				Theory		Practical		Total Marks	Minimum Passing	
			L	T	P	Total	T/T	Practical	Total		Theory+ MCQ External	Skill Enhancement Module	Internal	External		Marks	Grade
1	DSC I Environment & Ecology	EVS (1S)	6	-	-	6	4.5	-	4.5	03	80	20	-	-	100	40	P
2	Lab	EVS 1S PR	-	-	6	6	-	2.25	2.25	03	-	-	25	25	50	25	P
3	Total		6	-	6	6	4.5	2.25	6.30	06	80	20	25	25	150	65	P

**L: Lecture, T: Tutorial, P: Practical**

# Student may complete their Internship/ Field Work/ Work experience from Second to Fifth semester of Bachelor of Science in the Programme, according to their convenience; @ denotes Non-Examination credits.

**Note:** Internship/ Apprenticeship/ Field Work Experience (during vacations of semester II to V This will carry 5 credits for learning of 150 hours. Its credits and grades will be reflected in final semester VI credit grade report.

**Scheme of Teaching, Learning & Examination leading to the Degree in Bachelor of Science in the Programme Environmental Science  
(Three years- Six Semester Degree Programme- C.B.C.S.)  
(B.Sc. Part I) Semester II**

Sr.	Subject	Subject code	Teaching & Learning Scheme							Duration of Exam Hours	Examination & Evaluation Scheme						
			Teaching Periods Per Week				Credits				Theory		Practical		Total Marks	Minimum Passing	
			L	T	P	Total	T/T	Practical	Total		Theory+ MCQ External	Skill Enhancement Module	Internal	External		Marks	Grade
1	DSC -2 Physical Environment & Natural Resources	EVS (2S)	6	-	-	6	4.5	-	4.5	03	80	20	-	-	100	40	P
2	Lab	EVS 2S PR	-	-	6	6	-	2.25	2.25	03	-	-	25	25	50	25	P
3	Total		6	-	6	6	4.5	2.25	6.30	06	80	20	25	25	150	65	P

**L: Lecture, T: Tutorial, P: Practical**

# Student may complete their Internship/ Field Work/ Work experience from Second to Fifth semester of Bachelor of Science in the Programme, according to their convenience; @ denotes Non-Examination credits.

**Note:** Internship/ Apprenticeship/ Field Work Experience (during vacations of semester II to V This will carry 5 credits for learning of 150 hours. Its credits and grades will be reflected in final semester VI credit grade report.

**Syllabus Prescribed for Three Year UG Programme**

**Programme : B.Sc.**

**Semester 1**

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
BOT(1S)/Botany	<b>DIVERSITY Of MICROBES , PHYCOLOGY, MYCOLOGYAND PHYTOPATHOLOGY</b>	72

**Cos**

After completion of this course successfully , the students would be able to

1. **understand** microbial diversity, reproduction and economic importance.
2. **differentiate** the microbes, algae and fungi on the basis of morphology, cellular organization, nutrition and metabolic activities.
3. **classify** and **identify** the various algal genera.
4. **classify** and **identify** the various fungal genera.
5. **Systematize** the plant diseases and their pathogens
6. **Apply** understanding of microbial diversity, phycoology and mycology for teaching primary to high school students

	Unit	Content
<b>UNIT-I</b>	<b>Introduction to Microbial World</b> <b>1.1</b> Important groups of Microorganisms- Prion, Viroids ,Viruses, Mycoplasma, Eubacteria, Archaeobacteria and Cyanobacteria <b>1.2</b> Viruses – General characteristics and Morphological types of viruses , Structure of TMV and SARS-CoV-2 (Covid-19) , Replication of viruses- lytic & lysogenic , Economic importance of viruses with reference to vaccine production. <b>1.3</b> General characteristics and Economic importance of Archaeobacteria, General characteristics, cell structure, reproduction and economic importance of bacteria with reference to industry (Fermentation and Medicines)	12
<b>UNIT-II</b>	<b>Cyanobacteria and Algae</b> <b>2.1</b> General characteristics, structure and reproduction of cyanobacteria. <b>2.2</b> Introduction to cryptogams. <b>2.3</b> General characteristics of algae with reference to habitat, thallus organization, pigmentation, reserve food and reproduction. <b>2.4</b> Classification according to F.E. Fritsch up to the classes <b>2.5</b> Economic importance of algae as food and in industry. 2.5.1 Ecological importance of Cyanobacteria with reference with soil fertility.	- - - - - - - - - 1 2
<b>Unit-III</b>	<b>Algae</b> General characteristics of following Classes and life cycle of respective genera. 3.1 Chlorophyceae - <i>Oedogonium</i> 3.2 Charophyceae - <i>Chara</i> ( only Morphology and Sex organs) 3.3 Xanthophyceae - <i>Vaucharia</i> 3.4 Phaeophyceae - <i>Ectocarpus</i>	12

	3.5 Rhodophyceae - <i>Batrachospermum</i>	
<b>UNIT-IV</b>	<b>Introduction to Fungi</b> 4.1 General Characteristics of Fungi 4.2 Classification of fungi (Ainsworth-1973)  4.3 General characteristics of following Subdivisions and life cycle of respective genera  4.3.1 Myxomycotina - <i>Stemonitis</i> 4.3.2 Mastigomycotina- <i>Albugo</i> 4.3.3 Zygomycotina - <i>Rhizopus</i> 4.3.4 Ascomycotina - <i>Aspergillus</i>	<b>12</b>
<b>UNIT-V</b>	<b>Fungi and Applied Mycology</b> <b>5.1</b> General characteristics of following Subdivisions and life cycle of respective genera  5.1.1 Basidiomycotina - <i>Puccinia graminis tritici</i> 5.1.2 Deuteromycotina - <i>Alternaria</i>  5.2 Lichen –Types and Economic importance 5.3 Applied mycology - Application of fungi in industry , medicines and agriculture	<b>12</b>
<b>UNIT-VI</b>	<b>Phytopathology</b> <b>5.1</b> General symptoms – Rust, smut , powdery mildew, downy mildew, blight , stem rot and root rot ,anthracnose, leaf spot etc. <b>5.2</b> Symptoms, Pathogen biology and disease management of Bacterial diseases- 5.2.1- Citrus canker 5.2.2- Angular leaf spot of cotton <b>5.3</b> Symptoms, pathogen biology and disease management of viral diseases- 5.3.1- Yellow vein mosaic of Bhindi 5.3.2-Curl leaf of papaya <b>5.4</b> Symptoms, pathogen biology and disease management of fungal diseases 5.4.1. Tikka disease of groundnut 5.4.2 Powdery mildew of <i>Tectona grandis</i> (Teak)	<b>12</b>
	<b>*SEM-- Mycotechnology and Phytopathology</b> <b>1.Mycorrhizal technology –</b> 1.1 Definition, types and application of Mycorrhiza 1.2 Arbuscular Mycorrhizal Fungi (AMF) - Isolation technique of AMF spores and identification. 1.3 Soil trap culture, Monoculture , Mass multiplication and Biofertilizer.  OR <b>2. Mushroom cultivation technology</b> 2.1 Nutritional and medicinal value of edible mushroom 2.2 Types of edible mushroom available in local area- <i>Agaricus bisporus</i> , <i>Pleurotus</i> . 2.3 Cultivation technology – infrastructure , substrate, polythene bags, vessels, sterilization ,preparation of spawn, bed preparation ,paddy straw (or locally available), etc. 2.4 Storage and marketing. Or <b>3. Study of plant pathology of local crop plants.</b> 1.1 Symptomology 1.2 Fungal diseases of cotton and soybean 1.3 Chemical fungicides against diseases of cotton and soybean. 1.4 Biological control	
	COs:- After completion of skill enhancement module learner will be able to <b>1. Acquire skill</b> of isolation of Arbuscular Mycorrhizal Fungal and also able to classify the various species of mycorrhiza. <b>2. Evaluate</b> the AMF spore in the soil sample of crop plants.	

	<ol style="list-style-type: none"> <li>3. <b>Establish</b> own production unit of mushroom cultivation</li> <li>4. <b>Asses</b> the economy of mushroom cultivation</li> <li>5. <b>Diagnosed</b> the local crop diseases.</li> <li>6. <b>Advise</b> the proper fungicides or other measures to prevent crop diseases.</li> </ol>
	<p><b>** Activities-</b></p> <ol style="list-style-type: none"> <li>1. Collection of rhizosphere soils from different locations and isolation of AMF spores from these soil samples and identification Submission of skill enhancement report with microphotographs of AMF species its culture. OR</li> <li>2. Hands on training to students on mushroom cultivation outside institution</li> <li>3. Visit to local mushroom cultivation center and submission of its report / Internship in mushroom cultivation center</li> <li>4. Arranging workshop of mushroom cultivation for hands on training within institution.</li> <li>5. Submission of activity report. OR</li> <li>1. Collection of diseased plant parts of soybean and cotton from local fields.</li> <li>2. Diagnosis of disease on the basis of symptoms and micro-examination or culturing of pathogen.</li> <li>3. Suggestion of fungicide or biological control.</li> <li>4. Report submission including photographs and microphotographs of host and pathogen.</li> </ol>

### Course Material/Learning Resources

#### Text books:

1. Dube, H. C. (1990). An Introduction to Fungi. Vikas Pub. House Ltd. New Delhi.
2. Gangulee, H. C. and Kar, A.K. (2001). College Botany Vol. II. Books and Allied Press Ltd. Kolkata.
3. Krushnamurthy, K. V. (2007). An advanced Text Book on Biodiversity: Principles and Practice. Oxford and IBH Publishing Kumar, H.D. (1988). Introductory Phycology. Affiliated East-West Pres Ltd. New Delhi.
4. Kumar, H. D. and Singh, H.N. (1976). A Text Book of Algae. Affiliated East-West Pres Ltd. New Delhi.
5. Mehrotra, R. S. and Aneja, C.R. (1990). An Introduction To Mycology, Wiley Eastern Ltd. New Delhi.
6. Pandey, B.P. (1994). A Text Book of Botany-Algae. S.Chand and Co. Ltd. New Delhi.  
<https://microbiologynote.com/12-best-books-for-plant-pathology/>
7. Pandey, S.N. and Trivedi, P.S. (1997). A Text Book of Botany Vol. II, Vikas Publishing House (P.) Ltd. New Delhi.
8. Pandey, S.N. and Trivedi, P.S. (1997). A Text Book of Botany Vol. I, Vikas Publishing House (P.) Ltd. New Delhi.
9. Pandey, S.N., Trivedi, P.S. and Mishra, S.P. (1995). A Text Book of Algae, Vikas Publishing House (P.) Ltd. New Delhi.
10. Parihar, N.S. (1977). Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
11. Parihar, N.S. (1984). An Introduction To Embryophyta Vol. I Bryophyta. Central Book Depot, Allahabad
12. Rashid, A. (1996). An Introduction To Bryophyta. Vikas Publishing House Ltd. New Delhi.
13. Saxena, A.K. and Sarbhai, R.M. (1992). A Text Book of Botany Vol. II Embryophyta. Ratan Prakashan Mandir, Agra.
14. Sharma, O.P. (1989). A Text Book of Fungi. Tata McGraw-hill Publishing Company Limited, New Delhi.
15. Sharma, O.P. (1990). A Text Book of Algae. Tata McGraw-hill Publishing Company Limited, New Delhi.
16. Smith, G.M. (1995). Cryptogamic Botany. Vol. II (Bryophytes and Pteridophytes). McGraw-Hill Book Company, New York and London 33
17. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
18. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
19. A Text book of microbiology – R.C. Dubey, S.Chand publication pvt ltd.
20. A Text book of microbiology – D.R. Arora, CBC, publication
21. A Text book of Botany – Diversity of microbes and cryptogams – Singh, Pande, Jain Rastogi publication meerut.

#### Reference Books:

1. Lee, R.E. (2008), Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Agrios, G.N. (1997), Plant Pathology, 4th edition, Academic Press, U.K.
3. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, 4th ed. 22
4. Prescott's microbiology - Christopher, J. Woolverton, Joanne M. Wiley-McGraw Hill
5. Webster, J. and Weber, R. (2007). Introduction to Fungi. 3rd edition. Cambridge University Press,
6. The Algae World - Dinabandhu Sahoo • Joseph Seckbach Editors Springer 2016

#### Weblink to Best Reference Books-

[https://www.bioexplorer.net/microbiology-textbooks.html/#Best\\_Microbiology\\_Textbooks](https://www.bioexplorer.net/microbiology-textbooks.html/#Best_Microbiology_Textbooks)

<https://microbiologynote.com/12-best-books-for-plant-pathology/>

#### Weblink to Equivalent MOOC on SWAYAM if relevant

<https://swayam.gov.in/explorer>

#### Weblink to Equivalent Virtual Lab if relevant:

<https://youtu.be/9JwkHjCTKtQ>

(<https://youtu.be/zIVvObvfXdw>)

[https://youtu.be/0OF8n\\_sY8as](https://youtu.be/0OF8n_sY8as)

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**Syllabus Prescribed for Three Year UG**

**Programme: B.Sc.**

**Semester 1**

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
<b>BOT(1S)/BOTANY</b>	<b>Practical</b>	<b>2</b>

**COs**

After completion of this course successfully , the students would be able to

1. Identify and classify the algae on the basis of morphology and other characters.
2. Create monograph of Algae and Fungi.
3. Demonstrate the structural details of viruses and bacteria included in practical work.
4. Evaluate the plant diseases of local plants and diagnosed the diseases on the basis of symptology.

**\* List of Practical/Laboratory Experiments/Activities etc.**

<b>1</b>	Study of types of bacteria from temporary / permanent slides / photographs.
<b>2</b>	Study of TMV and SARS CoV-2 Viruses from Models/ Photographs.
<b>3</b>	Algae - Preparation of temporary mount, identification with reasons of following algal materials :  <i>Nostoc, Oedogonium, Chara, Vaucheria, Ectocarpus, Batrachospermum</i>
<b>4</b>	<b>Fungi and Plant Pathology :</b>  <ol style="list-style-type: none"> <li>1. Study of following Genera - <i>Stemonitis,, Albugo, Rhizopus, Aspergillus, Puccinia, Cercospora,</i></li> <li>2. Study of Crustose, Fruticose and Foliose lichen.</li> <li>3. Study of symptoms of fungal, viral, bacterial diseases.</li> </ol> Photographic herbarium of diseased plant parts from local region
<b>Additional Activities</b>	<ol style="list-style-type: none"> <li>1. Botanical Excursion (short/long)</li> <li>2. Visit to any biodiversity rich area to study the plant diversity in natural habitat.</li> </ol> The botanical excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	<ol style="list-style-type: none"> <li>1. Photographic herbarium of diseased plant plants.</li> <li>2. Tour reports or field visit report</li> </ol>

Faculty: Science and Technology

Programme: B.Sc (Botany)

Syllabus Prescribed for Three Year UG/PG Programme: B.Sc

Semester- II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
BOT( 2 S)/Botany	Bryophytes, Pteridophytes, Gymnosperms and Morphology of Angiosperms	60

**COs**

- After completion of this course successfully , the students would be able to
1. demonstrate on **understanding** of Archegoniate, Bryophytes, Pteridophytes and Gymnosperms.
  2. **identify** and **classify** plants from Bryophytes, Pteridophytes and Gymnosperms.
  3. develop **critical thinking** on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
  4. acquire **skill** of collection and preservation of Bryophytes, Pteridophytes and Gymnosperms

Unit	Content
<b>Unit I: Bryophytes</b> 1.1 General characteristics, affinities with algae and pteridophytes and Classification of Bryophytes by G.M.Smith 1.2 Morphology, Anatomy and Reproduction of i) Marchantiales : <i>Marchantia</i> ii) Anthocerotales : <i>Anthoceros</i> iii) Briales : <i>Funaria</i> 1.3 Ecological and Economical Importance of Bryophytes	12
<b>Unit II: Pteridophytes</b> 2. 1 General characteristics of Pteridophytes 2. 2 Types of Stele in Pteridophytes 2. 3 Classification of Pteridophytes by G.M.Smith 2. 4 Morphology, Anatomy and Reproduction of i) Sphenopsida : <i>Equisetum</i> ii) Lycopsida : <i>Selaginella</i> iii) Filicopsida : <i>Marsilea</i>	12
<b>Unit III: Gymnosperms and Palaeobotany</b> 3.1 General characteristics and affinities of Gymnosperms with Angiosperm 3.2 Classification of Gymnosperms by D.D. Pant 3.3 Morphology, Anatomy and Reproduction of i) Coniferopsida : <i>Pinus</i> ii) Gnetopsida : <i>Gnetum</i> 3.4 Economic importance of Gymnosperms. 3.5 Process of plant fossilization and types of fossils.	12
<b>Unit IV: Morphology of Angiosperms</b> 4.1 Life cycle pattern : Annual, Biennial and Perennial 4.2 Angiosperm plant body : Morphology and Modification of Root and Stem 4.3 Leaf : Types, Modifications , Phyllotaxy, Venation and Stipules 4.4 Inflorescence : Racemose ,Cymose and Special Types 4.5 Flowers: Structure of Flower- Calyx, Corolla, Androecium, Gynoecium and Placentation	12
<b>Unit V: Utilization of Plant Wealth</b> 5.1 Fruits : Morphology and Type 5.2 Morphology, variety and economic importance of 5.2.1 Food plant: Cereal- Wheat ( <i>Triticum aestivum</i> ) ; Pulses- Pigeon pea ( <i>Cajanus cajan</i> ), 5.2.2 Spices : Cardamom ( <i>Ellataria cardamomum</i> ), 5.2.3 Oil yielding plants : Sunflower ( <i>Helianthus annus</i> ) 5.2.4 Fiber Plants: Cotton ( <i>Gossypium sp.</i> ), 5.2.5 Essential oils- Plant Description and Uses – Rose ( <i>Rosa sp.</i> ), Nilgiri oil ( <i>Eucalyptus sp.</i> )	12

<p><b>Unit VI : Traditional Knowledge of Medicinal Plants</b> Morphology, Phytochemistry and medicinal uses of</p> <ol style="list-style-type: none"> <li>6.1. <i>Aloe vera</i></li> <li>6.2. <i>Adhatoda vasica</i></li> <li>6.3. <i>Asparagus racemosus</i></li> <li>6.4. <i>Azadirachta indica</i></li> <li>6.5. <i>Catharanthus roseus</i></li> <li>6.6. <i>Chlorophytum borivillianum</i></li> <li>6.7. <i>Emblica officinalis</i></li> <li>6.8. <i>Ocimum sanctum</i></li> <li>6.9. <i>Rauwolfia serpentina</i></li> <li>6.10. <i>Vitex negundo</i></li> <li>6.11. <i>Withania somnifera</i></li> <li>6.12. <i>Tinospora cordifolia</i></li> </ol>	12
<p><b>*SEM : Skill Enhancement Module</b> <b>Herbal Technology</b></p> <ol style="list-style-type: none"> <li>1. Definition and Scope of Herbal Technology</li> <li>2. Overview of “Ayush”</li> <li>3. Cultivation, harvesting, processing and storage of herbal plant parts and product</li> <li>4. Morphology and Microscopic Examination. And Preliminary Phytochemistry of             <ol style="list-style-type: none"> <li>i) <i>Catharanthus roseus</i></li> <li>ii) <i>Ocimum sanctum</i></li> <li>iii) <i>Azadirachta indica</i></li> <li>iv) <i>Achyranthes aspera</i></li> <li>v) <i>Aloe vera</i></li> </ol> </li> </ol> <p><b>COs:</b> On completion of this course the students will able to</p> <ol style="list-style-type: none"> <li>1. Understand the herbal technology.</li> <li>2. Develop the skill for cultivation of plants.</li> <li>3. Acquire the skill of morphological and microscopic examination of herbal plants.</li> <li>4. List the major herbs, their Botanical names and chemical constituent’s.</li> </ol>	
<p><b>**Activities</b></p>	<ol style="list-style-type: none"> <li>1. Photographic collection and preparation of e-herbarium of medicinal plants</li> <li>2. Cultivation of herbal medicinal plants in college garden, home kitchen garden.</li> <li>3. Preliminary phytochemical analysis of Mentioned medicinal plants</li> <li>4. Microscopic preparation of herbal medicinal plants and its microphotography.</li> <li>5. Project on local herbal plants to be submitted at the end of session.</li> </ol>

### Course Material/Learning Resources

#### Textbooks:

- 1) A.C. Dutta : Text Book of Botany.
- 2) Andrews A.N. : Studies in Paleobotany.
- 3) Arnold C.A. : Introduction of Paleobotany.
- 4) Bhatnagar S.P. and Moitra A., 1996 : Gymnosperms, New Age International Limited, New Delhi.
- 5) Bhojwani & Bhatnagar : Embryology of Angiosperms.
- 6) Coulter M.J. & Chamberlain C.J. : Morphology of Gymnosperms.
- 7) Cutter E.G., 1971 : Plant Anatomy Experiment and Interpretation Part-II, Organs, Edward Arnold, London.
- 8) Cutter, E.G. 1969 : Part-I, Cells and tissues, Edward, Arnold, London.
- 9) Davis P.H., and Heywood V.H., 1993 : Principles of Angiosperm Taxonomy: Oliver and Boyd, London.
- 10) Eames E.J. : Morphology of vascular Plants.
- 11) Gangulee & Kar : College Botany Vol.II
- 12) Gangulee Das and Dutta : College Botany, Vol.I
- 13) Gifford E.M. and Foster A.S., 1988 : Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
- 14) Hartmann H.T. and Kestler D.E., 1976 : Plant Propagation Principles and practices, 3rd edition, prentice Hall of India Pvt.Ltd. New Delhi.
- 15) Heywood V.H. and Moore D.M. (Eds) 1984 : Current concepts plant Taxonomy. Academic Press, London.
- 16) Jeffrey C., 1982: An introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
- 17) Maheshwari P. : Introduction of Embryology of Angiosperms.
- 18) Pande B.P. : A Text Book of Angiosperms.
- 19) Proctor M. and Yeop, 1973 : The Pollination of Flowers, William Collins Sons, London.
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- 21) Rendle A.B. : Classification of flowering plants, Vol.I & Vol.II.
- 22) S. Sundar Rajan : College Botany, Vol.II & Vol.III.
- 23) Saxena and Sarabhai : A Text Book of Botany, Vol.II
- 24) Sharma O.P. : Gymnosperms.

- 25) Shukla & Mishra :Paleobotany.
  - 26) Singh and Jain: Taxonomy of Angiosperms.
  - 27) Singh, 4. 1999, Plant Systematics - Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi.
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  - 31) Stewart W.N., 1983 :Paleobotany and Evolution of Plants, Cambridge University Press, Cambridge.
  - 32) Thomas P., 2000: Trees - Their natural history, Cambridge University Press, Cambridge.
  - 33) Trivedi B.S. & Sharma B.B. : Introductory Taxonomy.
  - 34) Tyagi&Kshetrapal : Taxonomy of Angiosperms.
  - 35) Vasistha P.C.: Gymnosperms.
  - 36) Vasistha P.C.: Taxonomy of Angiosperms.
  - 37) VyasPurohitGarg : A Text Book of Gymnosperms.
  - 38) Walton: An Introduction & Study of fossil.
  - 39) Modern Practical Botany, Volume-I, Dr.P.B.Pande, S.Chand Pub., N.W.
  - 40) Modern Practical Botany, Volume-II, Dr.P.B.Pande, S.Chand Pub., N.W.
  - 41) Modern Practical Botany, Volume-III, Dr.P.B.Pande, S.Chand Pub., N.W. Sahni, K.C. 2000.
  - 42) The Book of Indian Trees, 2nd edition. Oxford University Press, Mumbai.
  - 43) Schery, R.W. 1972. Plant for Man. 2nd Ed. Englewood Cliffs, New Jersey. Prentice Hall.
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  - 45) Swaminathan, M.S. and Kocchar, S.L. (Eds) 1989. Plants and Society. Macmillan Publication Ltd., London.
  - 46) Thakur, R.S., Puri, H.S. and Husain, A. 1989. Major and Aromatic Plants, CSIR, Lucknow.
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  - 48). Wagner, H., Hikino, H. and Farnswarth, N. 1989. Economic and Medicinal Plant Research, Vols. 1-3. Academic Press, London.
  - 49) Walter, K.S. and Gillett, H.J. 1998. 1997 IUCN Red List of Threatned Plants. IUCN, the World Conservation Union, IUCN, Gland, Switzerland, and Cambridge, U.K.
- 50) A Text Book of Botany –Paleobotany, Gymnosperms, Morphology and Utilization of Plants (2014),  
Dr.P.W.Deotare, Dr.M.A.Shahezad, Dr.Mrs.U.G.Malode, Dr.U.S.Patil, Dr.Mrs.P.S.Kokate,113 114  
Dr.Mrs.S.P.Khodke, Published by NabhPrakashan, Amravati.
  - 51) Morphology of Angiosperms and Utilization of Plants, Dr.Shubhangi Ingole, Published by PaygunPublishers, Amravati.

#### Reference Books:

- <https://www.sanfoundry.com/best-reference-books-bryophyta-pteridophyta-gymnosperm-palaeobotany/>
- <https://link.springer.com/chapter/10.1007/978-3-662-02604-5>
- [https://books.google.com/books/about/An\\_Introduction\\_to\\_Archegoniate\\_Plants.html?id=0Uh1DwAAQBAJ](https://books.google.com/books/about/An_Introduction_to_Archegoniate_Plants.html?id=0Uh1DwAAQBAJ)
- WeblinktoEquivalentMOOConSWAYAMifrelevant:
- <https://swayam.gov.in/explorer>
- WeblinktoEquivalentVirtualLabifrelevant:
- Anypertinentmedia(recordedlectures,YouTube,etc.) if relevant:
- <https://youtu.be/Ru96iXsWpyg>
- <https://youtu.be/IczPZPt281E>

**Sant Gadge Baba Amravati University,  
Amravati Syllabus Prescribed for Three Year UG/PG Programme  
Programme: B.Sc**

**Semester II**

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
<b>BOT(2S)/Botany</b>	<b>Bryophytes, Pteridophytes, Gymnosperms and Morphology of Angiosperms, Utilization of Plants</b>	<b>02</b>

**COs**

By the end of the Lab/Practical Course, generally students would be able to:

- 1) Understand forms of Bryophytes, Pteridophytes and Gymnosperms.
- 2) Acquire the skill of preparation of slides of plant body and reproductive organs.
- 3) Classify and identify different plant parts on the basis of external morphology.
- 4) Describe the plants in technical language.
- 5) develop critical understanding on morphology, botanical names and cultivation practices of economically important plants..

**\*List of Practical /Laboratory Experiments/Activities etc.**

1	Bryophytes : Study of morphology and anatomy of vegetative and reproductive parts of following genera – <i>Marchantia, Anthoceros, Funaria</i>
2	Pteridophyta: Study of morphology and anatomy of vegetative and reproductive parts of following genera – <i>Selaginella, Equisetum, Marsilea</i>
3	Gymnosperms: Study of morphology and anatomy of vegetative and reproductive parts of following genera – <i>Pinus, Gnetum</i>
4	Study of types of fossil.
5	Morphology:- Detail morphological study of following types of plant parts - Root , Stem , Leaves, Stipule, Inflorescence, Flower , Placentation, Fruits
6	Utilization of plants: Morphology varieties and economic importance of following plants  i) Food plants-Wheat ii) Pulses – Pigeonpea iii) Spices- Cardamom iv) Oil yielding plants- Sunflower v) Fiber yielding- Cotton vi) <i>Mentha piperata</i> (only uses) vii) <i>Eucalyptus</i> (only uses)
7	Medicinal plants- . <i>Aloe vera, Adhatoda vasica, Asparagus racemosus, Azadirachta indica, Catharanthus roseus, Chlorophytum borivillianum, Emblica officinalis, Ocimum sanctum, Rauwolfia serpentina., Vitex negundo, Withania somnifera, Tinospora cordifolia</i>
Additional Activities	1. Botanical Excursion (short/long) 2. Visit to any biodiversity rich area to study the plant diversity in natural habitat. 3. The botanical excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination.

	4. Photographic collection of bryophytic, pteridophytic and gymnospermic plants specimens
Submission	1. Photographic herbarium of Bryophytes, Pteridophytes, Gymnosperms etc. 2. Botanical excursion report

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**Sant Gadge Baba Amravati University, Amravati**

**Part A****Faculty: SCIENCE and TECHNOLOGY****Programme: B.Sc. (Botany)****Part B****Syllabus Prescribed for three Year UG Programme: Botany****GENERAL INTEREST COURSE-1****Semester 1**

<b>Code of the Course/Subject</b>	<b>Title of the Course/Subject</b>	<b>(Total Number of Periods)</b>
<b>BOT(1S) Botany</b>	<b>GIC-1 / Floriculture and Landscaping</b>	<b>30</b>

**COs**

After completing this course, the students would be able to

1. understand techniques of floriculture and landscaping
2. undertake project work, extracurricular activities
3. implement professional skill, knowledge & employability skills while performing jobs.
4. Create landscaping and adapt floriculture as profession or hobby

<b>Unit</b>	<b>Content</b>
<b>Unit I: Floriculture</b> 1.1 Introduction, Importance and scope of Floriculture 1.2 Plant propagation techniques: 1.2.1 Vegetative methods- Rhizome, Corm, Bulb, Sucker, Offset, Tuber, Bulbils 1.2.2 Artificial methods- Budding, Grafting, Cutting, Layering Propagating media and potting techniques. 1.3 Study of flowering annuals, biennials and perennials 1.4 Study of cultivation practices, Disease and pest management of following plants Rose, Chrysanthemum, Gladiolus, Marigold, Gaillardia and Gerbera 1.5 Importance of flower shows and exhibitions 1.6 Commercial production of Floricultural crops, Harvesting, grading, storage, packaging and marketing	<b>15 (periods)</b>
Unit II <b>Unit II: Landscaping(15 L)</b> 2.1 Aim, objectives and importance of landscaping 2.2 Designing map, individual and institutional landscaping. 2.3 Precautions and maintenance for durability of landscaping. 2.4 Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, dam sites, IT parks, corporate. 2.5 Interior scaping: Introduction, Necessity, Role and opportunities. 2.6 Materials used in Interior scape, selection of plants, design and Maintenance.	<b>15 (periods)</b>

### Course Material/Learning Resources

#### Text books:

1. Text book of floriculture and landscaping, Anil K Singh, AnjanaSisodia
2. Objective Floriculture and Landscaping by Desh Raj
3. Introductory Ornamental Horticulture and landscape garden, Rajaneeh Singh and Bijendrakumarsingh
4. GARDEN Revitalizing Ideal Necessities, by Amravati Garden Club
5. Floriculture in India, G S Randhava and A. Mukhopadhy
6. Floriculture, Landscaping and Turf Management by AlagarsamyNithya Devi and Alagarsamy Ramesh Kumar
7. Floriculture and Landscaping –Vol.1 by NayaUdyog and T K Bose
8. Floriculture and Landscaping at a Glance by LaxmiLalSomani
9. Text Book on Commercial Floriculture and Ornamental Horticulture with Landscape Architecture by Ashok Kumar and Abhinav Kumar
10. Laurie, Alex and Ries, Victor (2004). Floriculture- Fundamentals and Practices. Agrobios, (India), Jodhpur
11. Beckett, Kenneth A (2002). The Encyclopaedia of Garden Plant. Silverdale Book
12. Prasad and Kumar (2005). Commercial floriculture. Agrobios (India) jodhpur.
13. Dey, S.C. (2000). Pot culture and Rosen.Agrobios 9India). Jodhpur.
14. Dey, S.C. (2003). Indore Gardening. Agrobios (India). Jodhpur.
15. Dey, S.C. (2003). Flower from bulbous plant. Agrobios (India)jodhpur.
16. Gardeners Encyclopaedia of Plant and Flower – the Royal Horticultural society (Dorling Kindersley, London).
17. McDonald, Elvin (2002). The 400 best garden plant. Quantum Books. London.
18. Wyman’s Gardening Encyclopedia Donald Wyman, Macmillan, co. London.
19. The Dictionary of Garden Plants in colour with House and Greenhouse plants Roy Hay and P.Synge (R.H.S. Mermeid Books,London.
20. The Books of Flowers AliceM.Coats, Chancellor Press, London.
21. Garden Flowers JoanComptn, Hamlyh publ. Gr.Ltd.London.
22. Handbook of multiplication of plants (1999) L.H.Bailey, Discovery Publ. House, N.Delhi.
23. *Gopaldaswamylyengar*: Complete Gardening in India, G.K.Rangan, Bangalore.

### Sant Gadge Baba Amravati University, Amravati

#### Part A

Faculty: SCIENCE and TECHNOLOGY

Programme B.Sc.

#### Part B

Syllabus Prescribed for three Year UGProgramme: Botany

#### GENERAL INTEREST COURSE-2

Ethnobotany and Ethnopharmacology

Semester- II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
BOT(2S) Botany	GIC-II / Ethnobotany and Ethnopharmacology	30

#### COs

After completion of this course, student would be able to

1. Appreciate the need to conserve floristic and cultural diversity of the region.
2. Rescue and document Ethnobotanicals for sustainable use of plant resources.
3. Understand the need for development of new drugs for safe and more rational use of herbal preparations.



4. develop laboratory skills in testing of herbal drugs and new commercial products.

<b>Unit I: Ethnobotany</b>	<b>Content</b>
<p>1. 1 Introduction, relevance, scope and status of Ethnobotany. Methods and techniques used in Ethnobotany - Field level activities for data collection- Approach, Documentation (Audio, Video recording, Photographs, Interview – Methods, Questionnaire, and Data sheet), Authentication of plantspecies (Field Book, Herbarium) Field and Lab Procedures, Peoples biodiversity Register (PBR).</p> <p>1. 2. Impact of Ethnobotany in herbal-medicine industry, land-use development, agriculture, forestry, betterment of rural livelihoods and education. Biodiversity and conservation of some useful medicinalplants.</p> <p>1.3.Plant used in ethno medicine- e.g.: Guggul (<i>Commiphora</i>), Musali (<i>Chlorophytum borivilum</i> ) Salai guggul ( <i>Boswellia serrata</i> ) Arjuna (<i>Terminalia arjuna</i>), turmeric (<i>Curcuma longa</i>) Preparation and their uses</p>	<b>15 (periods)</b>
<p><b>Unit II: Ethnopharmacology</b></p> <p><b>15 Lecture</b></p> <p>2.1 Introduction, scope and relevance of Ethnopharmacology. Brief account of Phytochemistry, pharmacodynamics and pharmacokinetics. Classification and sources of crude drugs. Quality, safety and efficacy of herbal medicines/ neutraceuticals</p> <p>2.2 Biological screening of herbal drugs - introduction and need for phytopharmacological screening: Antimicrobial screening of herbal drugs, Screening for anticancer activity, Screening for antioxidant activity, Screening for Antiurolithiatic. Screening for anti-inflammation and analgesic activity, Screening for antiulcer activity, Screening for antidiuretic activity, Screening for liver related disorders. Database on pharmaceutical uses of plants.</p> <p>2.3 Plants used by ethnic groups as food, medicines (Ethnomedicine), beverages, fodder, fibre, resins, oils, fragrances and other uses. NWFP (Non-Wood Forest Produces), animal products, minerals, artifacts, and rituals, used by Tribal and Folk Communities of Melghat (Amravati ,Maharashtra)</p> <p>2.4 Role of ethnomedicine and its scope in modern times.</p> <p>2.5 Role of Ethnobotany in conservation and sustainable development</p>	<b>15 (periods)</b>

## Course Material/Learning Resources

### Suggested Readings

- 1) Akerele, O., Heywood, V. and Synge, H. (1991). *The Conservation of Medicinal Plants*. Cambridge University Press.
  - 2) AYUSH ([www.indianmedicine.nic.in](http://www.indianmedicine.nic.in)). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
  - 3) CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). *Aush Gyanya: Handbook of Medicinal and Aromatic Plant Cultivation*.
  - 4) Dev, S. (1997). Ethnotherapeutics and modern drug development: The potential of Ayurveda. *Current Science* 73:909–928.
  - 5) Jain, S.K. and Jain, Vartika. (eds.) (2017). *Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects*. Deep Publications, Delhi
  - 6) Saroya, A.S. (2017). *Ethnobotany*. ICAR publication.
  - 7) Thakur, R. S., H. S. Puri, and Husain, A. (1989). *Major medicinal plants of India*. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.
  - 8) Traditional plant medicines as sources of new drugs. P J Houghton in *Pharmacognosy Trease and Evan's*. 16 Ed .2009
  - 9) Cunningham, A. B. (2001). *Applied Ethnobotany*. Earthscan publishers Ltd. London & Sterling, VA, USA Cotton, C.M. (1996).
  - 10) *Ethnobotany-Principles and application*. John Wiley& Sons Ltd., West Sussex, England
  - 11) *In vivo and in vitro assays Glimpses of ethnopharmacology 1994* Eds. P Pushpangadan ,V George and U.Nyman
  - 12) Faulks, P.J. (1958). *An introduction to Ethnobotany*, Moredale Publ. London
  - 13) Jain, S. K. (1981). *Glimpses of Indian Ethnobotany*. Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
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