

Progressive Education Society's
Modern College of Arts, Science and Commerce,
Shivajinagar, Pune - 5

First Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU1101 **Course Name: Phycology and Mycology**

Teaching Scheme: TH: 2 Hours/Week

Credit: 02

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Pre-requisite: A student should have a thorough background in Biology learnt at 10+2 level.

Course Objectives:

- To familiarize students with general features, classification, and life cycle patterns in algae and fungi.
- To develop analytical skills to classify and differentiate among various types of algae and fungi.
- To Encourage critical thinking on the significance of algae and fungi
- To prepare the students with abilities related to laboratory and field-based studies.
- To create the base for advanced studies in Botany.

Course Outcomes:

On completion of this course, students will be able to:

- Describe the general characteristics, classification, and life cycle patterns in algae and fungi.
- Understand the ecological roles and significance of algae and fungi.
- Distinguish between different classes and subclasses of algae and fungi.
- Acquire knowledge about the potential uses of these organisms in industrial sectors.

Course Contents

Section I - Algae		
Unit 1	Algae	4 Lectures
	1.1. General characters - habitat, thallus diversity, cell structure, flagellation, pigmentation and food reserve, reproduction and life cycle patterns. 1.2. Outline classification according to Chapman and Chapman (1973) up to classes with reasons. 1.3. Economic importance of algae.	

Unit 2	Cyanophyta and Xanthophyta	3 Lectures
	2.1. General characteristics, occurrence, range of thallus organization, cell structure, and reproduction. 2.2. Morphology and life-cycle of <i>Nostoc</i> and <i>Vaucheria</i> .	
Unit 3	Chlorophyta and Charophyta	4 Lectures
	3.1. General characteristics, occurrence, range of thallus organization, cell structure, and reproduction. 3.2. Morphology and life-cycles of <i>Spirogyra</i> and <i>Chara</i> .	
Unit 4	Phaeophyta and Rhodophyta	4 Lectures
	4.1. General characteristics, occurrence, range of thallus organization; cell structure; reproduction. 4.2. Morphology and life-cycles of <i>Sargassum</i> , and <i>Batrachospermum</i> .	
Section II - Fungi		
Unit 1	Introduction to fungi	3 Lectures
	1.1 General characters, thallus organization, cell wall composition, nutrition and classification. 1.2 Economic importance of fungi	
Unit 2	Chytridiomycota and Zygomycota	4 Lectures
	2.1. General characteristics - thallus organization, reproduction. 2.2. Life cycle and classification with reference to <i>Synchytrium</i> , <i>Rhizopus</i> .	
Unit 3	Ascomycota	4 Lectures
	3.1. General characteristics - asexual and sexual fruiting bodies, heterokaryosis and parasexuality. 3.2. Life cycle and classification with reference to <i>Saccharomyces</i> .	
Unit 4	Basidiomycota	4 Lectures
	4.1. General characteristics	

	4.2. Life cycle and classification with reference to black stem rust on wheat <i>Puccinia</i> .	
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Suggested readings:

1. Alexopoulos CJ, Mims CW and Blackwell M (2007) Introductory Mycology, 4th edition. Wiley Publication.
2. Chopra R.N. and Kumar P.K. (1988). Biology of Bryophytes. John Wiley & Sons, New York.
3. Dube HC (2012) An Introduction to Fungi, 4th Edition. Scientific Publishers.
4. Gangulee HS, Das KS and Datta C (2011) College Botany Vol. I, New Central Book Agency(P) Ltd.
5. Kumar HD (1999) Introductory Phycology, East Western Press, New Delhi.
6. Mehrotra R.S. and Aneja K.R. (1990). An introduction to mycology. New Age Publishers.
7. Sharma OP (1988) Textbook of Fungi, McGraw-Hill Higher Education.
8. Sharma OP (1992) Textbook of Thallophytes, McGraw Hill Pub. Co.
9. Sharma PD (2017) Fungi and Plant pathology, Rastogi Publication.
10. Sinha V, Pande PC and Jain DK (2018) A text book of Botany: Biodiversity, Rastogi Publication, Meerut.
11. Smith GM (1971) Cryptogamic Botany. Vol. I Algae and Fungi, Tata McGraw Hill Publishing Co. New Delhi.
12. Vashishtha BR (2012) Botany for Degree Students Part I Algae, S. Chand and Company, New Delhi.
13. Vashishtha BR and Sinha AK (2012) Botany for Degree Students Fungi, S. Chand and Company, New Delhi.

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**First Year of B.Sc. Botany
(2024 Course under NEP 2020)**

Course Code: 24ScBotU1102

**Course Name: Lab course on
24ScBotU1101**

Teaching Scheme: PR: 4 Hours/Week

Credit: 02

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Pre-requisite: A student should have a thorough background of biology learnt at 10+2 level and basic knowledge of laboratory skills.

Course Objectives:

- To learn morphological features and mode of reproduction for identification of algae and fungi.
- To expose students to the industrial applications of algae and fungi.
- To foster an understanding of the diversity and ecological roles of algae and fungi through field visits

Course Outcomes:

On completion of this course, students will be able to:

- Identify the macroscopic and microscopic characteristics of algae and fungi, as well as gain expertise in the identification and classification of different species.
- Analyze the significance of different algal and fungal products in various industries.
- Understand the diversity and ecological roles of various algae and fungi species through direct field experiences.

Course Contents: (Any Fifteen)

1. Study of <i>Nostoc</i>	1P
2. Study of <i>Vaucheria</i>	1P
3. Study of <i>Spirogyra</i>	1P
4. Study of <i>Chara</i>	1P
5. Study of <i>Sargassum</i>	1P
6. Study of <i>Batrachospermum</i>	1P
7. Study of <i>Agaricus</i>	1P
8. Study of <i>Synchytrium</i>	1P
9. Study of <i>Rhizopus</i> .	1P
10. Study of <i>Saccharomyces</i>	1P
11. Study of <i>Puccinia</i>	1P
12. Study of algal products	1P
13. Cultivation of fungal biofertilizer/biocontrol agent	2P
14. Study of fungal products	1P
15. Field visit	2P

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First Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU1401

Course Name: Organic Farming

Teaching Scheme: TH: 2 Hours/Week

Credit: 02

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses: A student should have basic knowledge of agricultural practices

Course Objectives:

- To understand the concept of organic farming.
- To study various models of organic farming.
- To understand plant nutrition and plant protection management

Course Outcomes:

On completion of the course, students will be able to—

- Know the benefits of organic farming
- Understand crop management practices
- Understand the impact of organic farming and indigenous practices on the environment

Course Contents

Unit 1	Introduction to organic farming	3 Lectures
	1.1. Farming, organic farming- concept and development. 1.2. Need, benefits and scope of organic farming. 1.3. Advantages and limitations	
Unit 2	Organic farming models	6 Lectures
	2.1. Natural farming 2.2. Fukuoka Japan and perma culture 2.3. Australian organic farming 2.4. Ecological farming 2.5. Palekar model 2.6. Introduction to organic certification	
Unit 3	Organic farming process	6 Lectures
	3.1. Concept of farming system 3.2. Developing organic farms	

	3.3. Important steps and methods	
Unit 4	Organic plant nutrient management	6 Lectures
	4.1. Organic manure- FYM/ Rural compost, oil cakes, vermicompost etc. 4.2. Green manure- green manure with leguminous crops in crop rotation 4.3. Other nitrogen-contributing plants 4.4. Biofertilizers, slurry and organic cultures 4.5. Integrated plant nutrient management	
Unit 5	Nutrient uptake and utilization by plants	6 Lectures
	5.1. From organics 5.2. From inorganics	
Unit 6	Organic crop production methods	4 Lectures
	6.1. Vegetables 6.2. Paddy 6.3. Crop planning and rotation design	

Suggested readings:

1. Joshi, M., Setty, T.K.P. and Prabhakarasetty (2006). Sustainability through Organic farming. 1st Edition. Kalyani Publishers, Ludhiana, India.
2. Kristensen P., Taji, A., Reganold, J., (2006). Organic agriculture: A global perspective. CSIRO Press, Victoria, Australia.
3. Sharma A. 2002. Handbook of organic farming. Agrobios. Jodhpur.
4. Veeresh, G.K., Shivshankar K., Suiglachar, M.A., (1997). Organic farming and sustainable agriculture. Association for promotion of organic farming, Bangalore.

Weblinks:

- <https://nptel.ac.in/course>
- <https://apeda.gov.in>
- www.permaculture.com
- www.ecosecretz.com

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First Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU1601 Course Name: Lab Course on Laboratory Skills in Botany

Teaching Scheme: PR: 4 Hours/Week

Credit: 02

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Pre-requisite: A student should have a thorough background of biology learnt at 10+2 level

Course Objectives:

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| 1. Basic laboratory practices - Guidelines, hazards, safety protocols | 1P |
| 2. Use and care of microscopes- Compound microscope, dissecting microscope, stereo zoom microscope | 1P |
| 3. Use and care of common laboratory equipment (electronic balance, pH meter, centrifuge, ovens, incubators, autoclave, laminar air flow, Soxhlet extractor, uv-vis spectrophotometer) | 2P |
| 4. Preparation of temporary and semi-permanent slides- whole mount and sections of plant organs | 1P |
| 5. Preparation of buffers, reagents and solutions | 2P |
| 6. Laboratory stains and staining procedures | 1P |
| 7. Histochemical localization of metabolites | 1P |
| 8. Qualitative tests of metabolites | 1P |
| 9. Methods of quantitative determinations (Titrations, Spectrophotometry, TWC) | 1P |
| 10. Techniques of plant preservation- Dry and wet preservations | 1P |
| 11. Applications of smartphones in botanical studies (Useful software and photography) | 1P |
| 12. Detection of adulterations in botanicals/botanical samples | 1P |
| 13. Design of experiment and analysis of data - Measurement of photosynthetic rate using leaf disc assays | 1P |

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First Year of B.Sc. Botany
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Course Code: 24ScBotU2101	Course Name: Fundamentals of Plant Biotechnology
Teaching Scheme: TH: 2 Hours/Week	Credit: 02
Examination Scheme: CIA: 20 Marks	End-Sem: 30 Marks

Pre-requisite: A student should have a thorough background in Biology learnt at 10+2 level.

Course Objectives:

- Understand the fundamental principles, definitions, and scope of plant biotechnology,
- Explore the significance and diverse applications of plant biotechnology, emphasizing its role in addressing global challenges
- Examine the production process, nutritional aspects, and technological implications of Single Cell Proteins (SCP)
- Analyze the principles, types, and modes of action of biocontrol agents, focusing on their applications in sustainable agriculture
- Investigate the wide-ranging applications of algae in biotechnology
- Investigate the wide-ranging applications of fungi in biotechnology

Course Outcomes:

On completion of this course, students will be able to:

- Demonstrate a comprehensive understanding of the principles, definitions, and historical development of plant biotechnology.
- Evaluate the significance and potential impact of plant biotechnology on addressing global challenges
- Acquire knowledge of SCP production, enabling them to assess the feasibility and applicability of SCP technology in different contexts.
- Develop proficiency in identifying and analyzing biocontrol agents
- Gain practical skills in algae cultivation, harvesting, and the production and application of biofertilizers

- Understand anaerobic digestion processes, fungal fermentation techniques, and product isolation methods, enhancing their ability to apply fungal biotechnology in industrial settings and bioprocess engineering.

Course Contents

Unit 1	Introduction to Plant Biotechnology	2 Lectures
	1.1. Definition and scope of plant biotechnology 1.2. Historical development and milestones 1.3. Importance and applications in agriculture, industry, and medicine	
Unit 2	Single Cell Proteins (SCP)	5 Lectures
	2.1. Introduction 2.2. Need for microbial production of SCP 2.3. Sources of microorganisms and the selection criteria 2.4. Nutritional aspects of SCP 2.5. SCP production process 2.6. Technological advantages and side effects of SCP	
Unit 3	Biocontrol	3 Lectures
	3.1. Principles of biocontrol: use of natural enemies to manage pests and diseases 3.2. Types and modes of action of biopesticides: microbial, botanical, and biochemical agents 3.3. Applications in integrated pest management and sustainable agriculture practices	
Unit 4	Algal Biotechnology	6 Lectures
	4.1. Applications of algae in biofuels, food, pharmaceuticals, and wastewater treatment 4.2. Techniques for algae cultivation and harvesting 4.3. Biofertilizers: nitrogen-fixing bacteria and algae, phosphate solubilizers 4.4. Production methods and application strategies of biofertilizers 4.5. Advantages and limitations of biofertilizers	
Unit 5	Fungal Biotechnology	6 Lectures
	5.1. Mycorrhizal biofertilizers	

	5.2. Anaerobic digestion process for biogas generation from organic waste 5.3. Types of biogas digesters: batch, continuous, and plug-flow systems 5.4. Industrial applications of fungi in fermentation 5.5. Techniques for fungal fermentation and product isolation – Citric acid fermentation	
Unit 6	Plant Tissue Culture	8 Lectures
	6.1. Introduction to plant tissue culture: historical perspective and applications 6.2. Plant tissue culture techniques: sterilisation, culture media and culture conditions 6.3. Micropropagation techniques: shoot proliferation, rooting, and acclimatisation 6.4. Callus and suspension culture: induction, maintenance, and regeneration, applications in genetic transformation and secondary metabolite production 6.5. Protoplast isolation techniques: enzymatic digestion and mechanical methods 6.6. Protoplast fusion: principles and applications in somatic hybridization and cybrids	

Suggested readings:

1. Gupta, P.K. Elements of Biotechnology. Rastogi Publications.
2. Jogdand, S.N. Advances in Biotechnology. Himalaya Publishing House.
3. Kalyan Kumar, D. An Introduction to Plant Tissue Culture. New Central Book Agency, New Delhi.
4. Collin, H. A. and Edwards, S. Plant Cell Culture. BIOS Scientific Publishers.

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First Year of B.Sc. Botany
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Course Code: 24ScBotU2102 Course Name: Lab Course on 24ScBotU2101

Teaching Scheme: PR: 4 Hours/Week

Credit: 02

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Pre-requisite: A student should have a thorough background of biology learnt at 10+2 level and basic knowledge of laboratory skills.

Course Objectives:

- To provide students with theoretical and practical knowledge of the cultivation techniques for microorganisms
- To introduce students to the production processes of biofertilizers and mushrooms
- To facilitate understanding of the citric acid fermentation process
- To explore the principles and methods of biodiesel production
- To investigate the effects of Effective Microorganisms (EM) solution on plant growth
- To familiarize students with the basic techniques of plant tissue culture

Course Outcomes:

On completion of this course, students will be able to:

- Demonstrate proficiency in the cultivation techniques of *Spirulina* and *Trichoderma*
- Design and implement production processes for biofertilizers
- Gain practical skills in the cultivation of *Pleurotus* mushrooms
- Acquire knowledge of citric acid fermentation principles and techniques
- Develop proficiency in biodiesel production methods
- Evaluate the effects of EM solution on plant growth and soil health
- Understand basic practical skills in PTC and handling of plant genomic DNA

Course Contents: (Any fifteen practical)

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| 1. Cultivation of <i>Spirulina</i> | 1P |
| 2. Cultivation of <i>Trichoderma</i> on suitable substrate | 1P |
| 3. Production of biofertilizers | 1P |
| 4. Preparation of compost from suitable biomass | 1P |

5. Demonstration of <i>Pleurotus</i> cultivation	1P
6. Citric acid fermentation and assay	2P
7. Biodiesel production from suitable sources	1P
8. Effect of Effective Microbes (EM) solution on plant growth	1P
9. Preparation of plant tissue culture media and sterilization	2P
10. Demonstration of embryo culture	1P
11. Demonstration of callus and suspension culture	2P
12. Isolation of protoplast	1P
13. Demonstration of isolation of plant genomic DNA	1P
14. Demonstration of electrophoresis	1P
15. Field Visit	1P

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First Year of B.Sc. Botany
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Course Code: 24ScBotU2401

**Course Name: Gardening
Practices and Maintenance**

Teaching Scheme: TH: 2 Hours/Week

Credit: 02

Examination Scheme: CIA: 40 Marks

End-Sem: 60 Marks

Prerequisite Courses: A student should have basic knowledge of plants, plant nurseries and gardens

Course Objectives:

- To understand the history and practices of gardening and its maintenance
- Learn to set up a garden and perform its maintenance

Course outcomes: On completion of the course, students will be able to–

- Gain knowledge in basic gardening practices
- Understand the basics of commercial project preparation for developing gardens

Course Contents

Unit 1	Introduction to Gardening	4 Lectures
	1.1. Definition, origin, history of gardening 1.2. Selection of site 1.3. Water source, sunlight, soil type, types of pot, potting and repotting method 1.4. Basic garden tools	
Unit 2	Types of Gardening	1 Lecture
	1.1. Container (vegetables and ornamentals) 1.2. Vertical (Ornamentals) 1.3. Kitchen (Herbs, spices) 1.4. Indoor 1.5. Window box 1.6. Terrace or roof gardens 1.7. Hanging pots	
Unit 3	Garden soil and soilless media	1 Lectures

	3.1. Soil Types 3.2. Fertility 3.3. PH testing, electrical conductivity (EC), and soil nutrition 3.4. Coco peat, perlite, vermiculite, soilrite, nutrient solutions, moss	
Unit 4	Water management	1 Lectures
	4.1. Drip irrigation system 4.2. Sprinkler	
Unit 5	Garden features	1 Lectures
	5.1. Arches 5.2. Water bodies 5.3. Fountains 5.4. Walking paths 5.5. Rock garden 5.6. Light effects 5.7. Stone, wooden stone furniture	
Unit 6	Plants used in Gardening	4 Lectures
	6.1. Herbs, shrubs, trees, and ground cover 6.2. Flowering (annual, biennials, perennials) and non-flowering (indoor) 6.3. Climbers and epiphytes 6.4. Ferns, cycads, palms 6.5. Cacti and succulents 6.6. Exotic plants	
Unit 7	Compost types	2 Lectures
	7.1. Bio fertilizer, vermi-compost, Kitchen waste compost 7.2. Methods of preparation and storage techniques	
Unit 8	Propagation techniques in gardening	4 Lectures
	8.1. Sexual (seed) and asexual (artificial) 8.2. Natural propagation	
Unit 9	Types of lawns and their maintenance	2 Lectures
	9.1. Types of grasses used in lawn 9.2. Watering 9.3. Disease and pest control	

Unit 10	Garden Practices	6 Lectures
	10.1. Basics of flower arrangement 10.2. Bottle garden, rock gardens, miniature gardens 10.3. Seasonal maintenance of garden plants 10.4. Training and Pruning	
Unit 11	Garden Projects	2 Lecture
	11.1. Guidelines for Garden contract project preparation, presentation, and implementation 11.2. Guidelines for budget preparation for startup/loan application 11.3. Marketing skills	
Unit 12	Personality development	2 Lectures
	12.1. Communication: Methods, meaning and functions, 12.2. Forms of communication: Oral and written communication, Non-verbal communication, interpersonal communication, organizational communication. 12.3. Key communicators: Meaning, characteristics and their role in development, communication skills	

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First Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU2601

**Course Name: Lab Course on
Seed Technology**

Teaching Scheme: PR: 4 Hours/Week

Credit: 02

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses: A student should have the subject Biology at 10+2 level.

Course Objectives:

- To learn seed testing methods
- To acquire practical skills in seed testing and other aspects
- To inculcate research aptitude among students

Course Outcomes:

On completion of this course, students will be able to:

- Acquire skills in various aspects of seed testing
- Design experiments and able to use tools and technology of seed testing
- Have better employment opportunities

Course Content (Any fifteen)

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| 1. Concept of seed technology, seed organizations and Seed Act | 1P |
| 2. Examination of seed - Types of seeds and their morphological characters | 1P |
| 3. Physical purity analysis of seeds | 1P |
| 4. Study of seed germination
Paper – Top paper, between paper and sand method | 1P |
| 5. Study of dormancy removal
Pre-chill, prewashing, mechanical scarification, acid scarification
H ₂ SO ₄ , GA ₃ treatment, hot water treatment and delinting in cotton | 2P |
| 6. Evaluation of germination
Germination percentage, epigeal and hypogeal germination
seedling evaluation (Normal seedling, abnormal seedling, hard seeds, fresh
ungerminated seeds and dead seeds) | 1P |

7. Seed viability test	1P
TZ test, X-ray, Embryo Excision, FeCl ₃ , Floatation methods	
8. Seed moisture testing	1P
Phosphorus pentoxide method, air oven method and using moisture meter	
9. Basics of seed entomology	1P
10. Basics of seed pathology	1P
11. Basics of seed biochemistry	2P
Isolation of seed storage proteins and Protein profiling by electrophoresis	
12. Study of mutation breeding	2P
Treatment of seeds with mutagenic agent, germination percentage and observation of seedlings and other plant	
13. Visit to Seed Processing Unit	1P
14. Visit to Seed Testing Lab	1P
