

**KAVAYITRI BAHINABAI CHAUDHARI
NORTH MAHARASHTRA UNIVERSITY,
JALGAON**

॥अंतरी पेटवू ज्ञानज्योत॥



'A' Grade
NAAC Re-Accredited
(4th Cycle)

National Education Policy- 2020

Subject Structure

For

**F. Y. B. Sc. BOTANY
Semester- I and II**

For

Affiliated Colleges

(With effect from June, 2024-25)

Preamble

Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon believes in implementing several measures to bring equity, efficiency and excellence in higher education system in conformity to the guidelines laid down by the University Grants Commission (UGC). In order to achieve these goals, all efforts are made to ensure high standards of education by implementing several steps to enhance the teaching-learning process, examination and evaluation techniques and ensuring the all-round development of students. F.Y.B. Sc. Botany has been designed to have a progressive and innovative curriculum in order to equip our students to face the future challenges in the field of higher education. The well-organized curricula including basic as well as advanced concepts in the plant sciences from first year to the third year shall inspire the students to pursue higher studies in Botany and become an entrepreneur and also enable students to get employed in the Botany subject-based industries. This course will help students to build on the basic information regarding classification of plant kingdom groups like algae, fungi, bryophytes, pteridophytes, gymnosperms & angiosperms. This course will also help students To be able to understand the physiology of plants & its importance & implications to human life National Education Policy (NEP – 2020) provides opportunities for internships with local industry, businesses, artists, crafts persons, etc., as well as research internships with faculty and researchers at their own or other HEIs/research institutions, so that students may inquiryly engage with the practical side of their learning and, as a by- product, further improve their employability. It also recognizing, identifying, and fostering the unique capabilities of each student to promote her/his holistic development objectives. The curriculum for the F. Y. B. Sc. Programme in Botany has been designed with an aim of encouraging the broad instructional goals and to support the growing demands and challenging trends in the educational scenario. It targets at providing an environment that encourages, promotes and stimulates the intellectual, professional and personal development of the student. The curriculum caters to the all-round development of the student, rolling out globally ready individuals into the fast-pacing world.

Objectives

- 2.1. The objective of the Bachelor's program in Botany is to equip the students to gain conceptual and analytical skills about morphological, anatomical, physiological, biochemical and cellular aspects of lower and higher plants.
- 2.2. The program emphasizes to apply knowledge acquired about different taxa of plants for their manipulations, biomolecules and conservation.
- 2.3. The imparting of laboratory training for bioassay protocols of biological materials, their manipulative treatments, emerging tissue culture and genetic recombinant techniques.

The curriculum for the F. Y. B. Sc. Programme in Botany has been designed with an aim of encouraging the broad instructional goals and to support the growing demands and challenging trends in the educational scenario. It targets at providing an environment that encourages, promotes and stimulates the intellectual, professional and personal development of the student. The curriculum caters to the all-round development of the student, rolling out globally ready individuals into the fast-pacing world.

1. Know the importance and scope of the discipline.
2. Inculcate interest in and love of nature with its myriad living forms.
3. Impart knowledge of science as the basic objective of Education.
4. Create a scientific attitude to make students open minded, critical and curious.
5. Develop the ability to work hard and make students fit for society.
6. Expose students to the diversity amongst life forms.
7. Develop skill in practical work, experiments, equipment's and laboratory use along with collection and interpretation of biological materials and data.
8. Make them aware of natural resources and environment and the importance of conserving it.
9. Develop the ability for the application of acquired knowledge in various field of life so as to make our country self-sufficient.
10. Appreciate and apply ethical principles t biological science research and studies.

Program outcomes

P01. Knowledge and understanding of:

1. The range of plant diversity in terms of structure, function and environmental relationships.
2. The evaluation of plant diversity.
3. Plant classification and the flora of Maharashtra.
4. The role of plants in the functioning of the global ecosystem.
5. A selection of more specialized, optional topics.
6. Statistics as applied to biological data.

P02. Intellectual skills-able to:

1. Think logically and organize tasks into a structured form.
2. Assimilate knowledge and ideas based on wide reading and through the internet.
3. Transfer of appropriate knowledge and methods from one topic to another within the subject.
4. Understand the evolving state of knowledge in a rapidly developing field.
5. Construct and test the hypothesis.
6. Plan, conduct and write a report on an independent term project.

P03. Practical skills: Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them depending on their choice of optional modules.

1. Interpreting plant morphology and anatomy.
2. Plant identification.
3. Vegetation analysis techniques.
4. A range of physiochemical analyses of plant materials in the context of plant physiology and biochemistry.
5. Analyze data using appropriate statistical method and computer packages.
6. Plant pathology to be added for sharing field and lab data obtained.

P04. Transferable skills:

1. Use of IT (word-processing, use of internet, statistical packages and databases).
2. Communication of scientific ideas in writing and orally.
3. Ability to work as part of a team.
4. Ability to use library resources.
5. Time management.
6. Career planning.

P05. Scientific Knowledge: Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyze any plant form.

P06. Problem analysis: Identify the taxonomic position of plants, formulate the research literature, and analyze non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

P07. Design/development of solutions: Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health.

P08. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and development of the information to provide valid conclusions.

P09. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern instruments and equipment for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.

P010. The Botanist and society: Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.

P011. Environment and sustainability: Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

P012. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

P013. Ethics: Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.

P014. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

P015. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1. Understand the diversity, systematic, morphology, lifecycle pattern and economic importance of Algae.

PSO2. Understand the diversity, systematic, morphology, lifecycle pattern and economic importance of Fungi.

PSO3. Understand the diversity, systematic, morphology, life cycle pattern and economic importance of Bryophyta.

PSO4. Understand the diversity, systematic, morphology, lifecycle pattern and economic importance of Pteridophyta and Gymnosperm.

PSO5. Understand the eukaryotic cell cycle and cell division in plants.

PSO6. Study Structure and organization of cell membrane and Process of membrane transport and membrane models.

PSO7. Explain Mendelian and Neo-mendelian genetics.

PSO 8. Understand importance and scope of plant physiology with respect to water relations, Photosynthesis and Respiration.

PSO9. Understand plant communities and ecological adaptations in plants.

PSO10. Know the concept of methodology in taxonomy.

PSO11. Learn about conservation of biodiversity, Non-conventional Energy and Pollution.

PSO12. Learn the scope and importance of molecular biology with emphasis on DNA and Protein synthesis.

PSO13. Understand the role plants in human welfare and Gain knowledge about various plants of economic use

PSO 14. Get the detail knowledge about modern strategies applied in Plant Breeding for crop improvement and Genome analysis.

Course Outcomes

1. The framework of the curriculum for the Bachelor's program in Botany aims to transform the course content and pedagogy to provide a multidisciplinary, student-centric, and outcome-based, holistic education to the next generation of students.
2. Aside from structuring the curriculum to be more in-depth, focused, and comprehensive with significant skill-set for all exit levels; keeping in mind the job prospects; the emphasis has been to maintain academic coherence and continuum throughout the program of study and help build a strong footing in the subject, thereby ensuring a seamless transition into their careers.
3. Special attention is given to eliminating redundancy, discouraging rote learning, and espousing a problem-solving, critical thinking, and inquisitive mindset among learners.
4. The curriculum embraces the philosophy that science is best learned through experiential learning, not limited to the confines of a classroom but rather through hands-on training, projects, field studies, industrial visits, and internships.
5. This updated syllabus, with modern technology, helps students stay informed on the leading edge developments in plant sciences and promotes curiosity, innovation, and a passion for research, that will serve them well in their journey into scientific adventure and discovery beyond graduation.
6. The goal is to equip students with holistic knowledge, competencies, professional skills, and a strong positive mindset that they can leverage while navigating the current stiff challenges of the job market

Semester-wise Code structure For F. Y. B. Sc. Botany

Programme as per NEP 2020,
For affiliated colleges w.e.f – June 2024.

Abbreviations:

- **T:** Theory Course
- **DSC:** Discipline Specific Core Course
- **DSE:** Discipline Specific Elective Course
- **MIN:** Minor subject
- **VSC:** Vocational Skill Courses
- **GE/OE:** Generic/open elective
- **IKS:** Indian Knowledge System
- **CEP:** Community engagement and service
- **RP:** Research Project methodology
- **MIL:** Modern Indian language
- **VSEC:** Vocational skill and Skill enhancement courses
- **OJT:** On Job Training: Internship/Apprenticeship
- **Co-curricular Course (CC)**
 - a) **CC-1:CC-120: Sports and Yoga**
 - b) **CC-2:CC-130: Cyber Security**
 - c) **CC-3:CC-220: Human Rights and Environment Law**
 - d) **CC-4:CC-229: Communication Skills and Personality Development**
- **Value Education Courses (VEC)**
 - a) **VEC1: ES-118: Environmental Science**
 - b) **VEC2: CI-129: Constitution of India**
- **Indian KnowledgeSystem(IKS):**
- **IK: 119: Ayurvedic Medicine in Ancient India**
- **Ability Enhancement Courses (AEC)**
 - a) **AEC-1:EG:101-English -1**
 - b) **AEC-2:EG:102-English-2**
 - c) **AEC-3:MR:201-Marathi-1**
 - d) **AEC-3: HN:201- Hindi-1**
 - e) **AEC-3:MR:202 -Marathi-2**
 - f) **AEC-3:HN:202-Hindi-2**
- **P:** Practical course
- **RM:** Research
- **ENG:** English
- **ES:** Environment studies
- **SEC:** Skill Enhancement courses
- **CI:** Constitution of India

**Semester-wise Code, Structure and Titles of the Courses For
F. Y. B. Sc Botany Semester I and II
(As per NEP-2020 Pattern)**

**Semester wise Code structure for F. Y. B. Sc Botany (Honors/Research)
Programme as per NEP 2020, for Affiliated Colleges w.e.f- June 2024-25.**

B. Sc. Botany (Honors/Research)-First Year, SEMESTER-I**, Level-4.5**

Course	Course Type	Course Code	Course Title	Credits	Teaching Hours /Week			Marks			
					T	P	Total	Internal (CA)		External (UA)	
								T	P	T	P
DSC-1	DSC	BO-111	Plant Diversity	2	2	--	2	20	--	30	--
DSC-2	DSC	BO-112	Lab- I Practical based on BO-111	2	--	4	4	--	20	--	30
OE-1	OE	BO-113	Plant Nursery and Management	2	2	--	2	20	--	30	--

B.Sc Botany (Honors/Research) – First Year, **SEMESTER-II, Level-4.5**

DSC-3	DSC	BO-121	Plant Morphology	2	2	--	2	20	--	30	--
DSC-4	DSC	BO-122	Lab –II Practical based on BO-121	2	--	4	4	--	20	--	30
OE-2	OE	BO-123	Food Technology	4	4	--	4	40	--	60	--

First Year B. Sc. Botany Semester- I

DSC- 1 Course Code: BO-111

Course Title: Plant Diversity

DSC- 1 Major (Core) Course [Lectures: 30] [2T]

BO-111 Plant Diversity

Course objectives:

1. To understand the characteristic features of Bacteria, Algae, Fungi, Lichen, Bryophytes, Pteridophytes and Phanerogams.
2. This course will help the student to understand the diversity of plants
3. Learn about the structure, pigmentation, food reserves and methods of reproduction of Algae.
4. Learn about the structure, pigmentation, food reserves and methods of reproduction of Algae, Fungi, Lichen, Bryophytes, Pteridophytes and Phanerogams.
5. To understand the diversity of Gymnosperms and Angiosperms.

Course outcomes:

1. Microscopic observation and identification of algae, fungi, bryophytes, lichens, pteridophytes and gymnosperm.
2. Observation of crop plants infected by the pathogens included in the syllabus and study of symptoms, causative agents and etiology.
3. Know the systematic, morphology and structure of Gymnosperms.
4. Understand the habit of the angiosperm plant body.
5. Know the vegetative characteristics of the plant.

Unit 1	Plant Diversity and Cryptogames 1.1 Introduction 1.2 Definition 1.3 Important objectives of plant diversity study 1.4 Different aspects of plant diversity w.r.t. organization, Cell structure, Habit and habitat, Mode of nutrition, Reproduction and Diversity of Life cycle Patterns. 1.5 General classification of Plant kingdom. 1.6 Introduction to cryptogams 1.7 General characters of cryptogams 1.8 Outline classification of Cryptogams	06 L
Unit 2	Algae and Fungi 2.1 Introduction to Algae 2.2 General characters w.r.t. Habit and habitat, Organization of thallus, Structure of algal cell, Pigments, Algal flagella, Nutrition, Food reserve and, Reproduction. 2.3 Distinguishing features of Algae 2.4 Outline classification of Algae upto classes with two examples of each class according to G. M. Smith (1955) 2.5 Economic importance of algae-positive and negative. 2.6 Introduction to Fungi	08 L

	<p>2.7 General characters w.r.t. Habit and habitat, Structure of thallus, Nutrition and, Reproduction in Fungi</p> <p>2.8 Distinguishing features of Fungi</p> <p>2.9 Outline classification of Fungi upto classes with two examples of each class according to G.M.Smith (1955)</p> <p>2.10 Economic importance of Fungi-positive and negative.</p>	
Unit 3	<p>Lichens and Bacteria</p> <p>3.1 Definition of Lichens</p> <p>3.2 Occurrence of Lichens</p> <p>3.3 Structure (external and Internal) of Lichens</p> <p>3.4 Types of Lichens</p> <p>3.5 Economic importance of Lichens.</p> <p>3.6 Introduction to Bacteria</p> <p>3.7 General characters of Bacteria</p> <p>3.8 Classification on the basis of morphology of Bacteria</p> <p>3.9 Gram positive and negative bacteria</p> <p>3.10 Economic importance (useful and harmful) of Bacteria</p>	04 L
Unit 4	<p>Bryophytes and Pteridophytes</p> <p>4.1 Introduction to Bryophytes</p> <p>4.2 General characters w.r.t. Habit and habitat, Forms of thalli, Reproduction and life cycle pattern of Bryophytes</p> <p>4.3 Distinguishing features of Bryophytes</p> <p>4.4 Outline classification of Bryophytes upto classes with two examples of each class according to G. M. Smith (1955)</p> <p>4.5 Economic importance of Bryophytes.</p> <p>4.6 Introduction to Pteridophytes</p> <p>4.7 General characters w.r.t. Habit and habitat, External and internal morphology of sporophyte, Reproduction and Alternations of generations of Pteridophytes.</p> <p>4.8 Distinguishing features of Pteridophytes</p> <p>4.9 Outline classification of Pteridophytes upto classes with two examples of each class according to G. M. Smith (1955)</p> <p>4.10 Economic importance of Pteridophytes.</p>	06 L
Unit 5	<p>Phanerogams:</p> <p>5.1 Introduction and General characters</p> <p>Gymnosperms:</p> <p>5.2 Introduction</p> <p>5.3 General characters</p> <p>5.4 Outline classification of Gymnosperms upto orders with two examples of each order according to Chamberlain's (1935)</p> <p>5.5 Economic importance of Gymnosperm.</p> <p>Angiosperms:</p> <p>5.6 Introduction</p> <p>5.7 General characters</p>	06 L

5.8 Outline classification of Angiosperms upto Series according to Bentham and Hooker's
5.9 Distinguishing features of class Monocotyledons and class Dicotyledons.

Suggested readings:

1. Agrawal, S. B. and Srivastav (1985) Modern Text Book of Botany Vol.I Algae, Fungi, Bacteria, Viruses and Lichen, Universal Publication, Agra.
1. Biswas, S. B. and Amita Biswas (1986 Ed.)An Introduction to Viruses, Vikas Publishing House (P) Ltd. New Delhi.
2. Vashista, B. R.(2010). A Text Book of Algae S. Chand and Company(P.) Ltd New Delhi.
3. Vashista, B. R. (2010). A Text Book of Fungi S. Chand and Company(P.) Ltd New Delhi.
4. Sarabhai, B. P. & Arora C. K. (1995). A Text Book of Algae Anmol Publication, New Delhi.
5. Salle, A. J. (1974) Fundamental Principles of Bacteriology (TMHed.) New Delhi.
6. Gangulee, H. C. and Kar, A.K. (1998) College Botany Vol. II New Central Book Agency, Kolkota.
7. Pandey B. P. (2014) College Botany Volume1 S. Chand publications, New Delhi.
8. Pandey, S. N. and Trivedi (1997) A Text Book of Botany Vol. I Vikas Publishing House, New Delhi.
9. Sharma P D. (1998) A Text Book of Fungi Rastogi Publication, Meerut.
10. Sharma, PD.(2009) A Text Book of Algae Tata McGraw Hill Publication, New Delhi
11. Das, Datta and Gangulee-College Botany Vol. I
12. Chopra G.L. and Yadav D.L. A Text book of Bryophytes.
13. Vashishta B.R. Botany for degree students Bryophytes- Vol-II
14. Vashishta B.R. Botany for degree students Pteridophytes.
15. Singh V. and D.K Jain, 1981 Taxonomy of Angiosperms. Rastogi Publication, Meerut. 4. Swingle D.B. 1946. A Text book of Systematic Botany. Mc Graw Hill Book Co. New York
16. Gurucharan Singh 2005- Plant systematics 8. Naik V.N. - Taxonomy of Angiosperms. 9. Shivrajan V.V. -Introduction to Principles plant taxonomy
17. <https://britannica.com/science/algae/classification-of-algae>
18. <https://www.greeksforgreeks.org/kingdom-fungi/>
19. <https://britannica.com/plants/bryophytes>

First Year B. Sc. Botany Semester- I
DSC- 2 Course Code: BO-112
Course Title: Laboratory- 1 Practical based on BO-111

DSC- 2 Major (Core) Course [Lectures: 60] [2T]
BO-112: Laboratory-1 Practical based on BO111

Course objectives:

1. Students will learn to carry out practical work in the laboratory.
2. Students will learn to study and describe the morphology and anatomy of various groups of lower plants.
3. They will learn to study and describe the morphology and anatomy of various groups of higher plants.
4. Students will be able to identify the major groups of microorganisms

Course outcomes:

1. Microscopic observation and identification of bacteria, algae, fungi, lichen, bryophytes, pteridophytes and phanerogams.
2. Observation of crop plants infected by the pathogens included in the syllabus and study of symptoms, causative agents and etiology.

Practical :1	Introduction to laboratory: A) Dissecting microscope-Mechanical operation B) Compound microscope- Mechanical operation
Practical:2	Preparation of fixatives, fixing agents, stains, mounting media A) Fixatives and Fixing agents: i) Formalin solution ii) Alcohol iii) Formalin acetic alcohol(FAA) B) Stains: i) Safranin ii) Crystal violet iii) Gram's Iodine iv) Lacto phenol v) Cotton blue C) Mounting media: i) Glycerin ii) Glycerin jelly
Practical :3	Study of Bacteria: 1) Types of Bacteria (On the basis of shapes) P.S. 2) Gram staining of Bacteria
Practical:4	Study of Bacterial diseases by using specimens 1) Citrus cancer 2) Black arm of Cotton
Practical:5	Study of Algal diversity(by temporary preparation of slides) w.r.t Systematic position and morphology of following: 1) <i>Spirogyra</i> 2) <i>Nostoc</i> 3) <i>Chara</i>
Practical:6	Study of range of thallus in algae: 1) Unicellular thallus 2) Colonial thallus 3) Filamentous thallus 4) Siphonaceous thallus P.S.
Practical: 7	Study of Fungal diversity (by temporary preparation of slides) w.r.t Systematic position and morphology of following: 1) <i>Rhizopus</i> 2) <i>Eurotium</i> 3) <i>Alternaria</i>

Practical: 8	Study of fungal diseases by using specimens/P.S.: 1) Club root disease (<i>Plasmodiophora</i>) 2) White rust (<i>Albugo</i>) 3) Tikka disease (<i>Cercospora</i>)
Practical: 9	Study of Lichens: 1) Types of Lichens (Specimens) 2) Internal structure of Lichen(P.S.)
Practical: 10	Study of Bryophytes diversity by using specimens w.r.t Systematic position and morphology of following 1) <i>Riccia</i> 2) <i>Anthoceros</i> 3) <i>Funaria</i>
Practical: 11	Study of Pteridophytes diversity by using specimens w.r.t Systematic position and morphology of following 1) <i>Psilotum</i> 2) <i>Selaginella</i> 3) <i>Equisetum</i>
Practical: 12	Study of Gymnosperms diversity by using Photographs/ Herbarium/Specimens w.r.t Systematic position and morphology of following 1) <i>Cycas</i> 2) <i>Pinus</i> 3) <i>Gnetum</i>
Practical: 13	Study of Angiosperm Dicotyledons diversity by using Photographs/ Herbarium/Specimens w.r.t Systematic position and morphology of following 1) Pea 2) Sunflower 3) Mango
Practical: 14	Study of Angiosperm Monocotyledons diversity by using Photographs/ Herbarium/Specimens w.r.t Systematic position and morphology of following 1) Maize 2) Sugarcane 3) Onion
Practical: 15	Field visit to observe plant diversity and writing of tour report

Suggested readings:

1. Agrawal, S. B. and Srivastav (1985) Modern Text Book of Botany Vol. I Algae, Fungi, Bacteria, Viruses and Lichen, Universal Publication, Agra.
2. Vashista, B. R.(2010). A Text Book of Algae S. Chand and Company(P.) Ltd New Delhi.
3. Vashista, B. R. (2010). A Text Book of Fungi S. Chand and Company(P.) Ltd New Delhi.
4. Sarabhai, B. P. & Arora C. K. (1995). A Text Book of Algae Anmol Publication, New Delhi.
5. Salle, A. J. (1974) Fundamental Principles of Bacteriology (TMHEd.) New Delhi.
6. Pandey B. P. (2014) College Botany Volume1 S. Chand publications, New Delhi.
7. Pandey, S. N. and Trivedi (1997) A Text Book of Botany Vol. I Vikas Publishing House, New Delhi.
8. Sharma P D. (1998) A Text Book of Fungi Rastogi Publication, Meerut.
9. Sharma, PD.(2009) A Text Book of Algae Tata McGraw Hill Publication, New Delhi
10. Das, Datta and Gangulee-College Botany Vol. I
11. Chopra G.L. and Yadav D.L. A Text book of Bryophytes.
12. Vashishta B.R. Botany for degree students Bryophytes- Vol-II
13. Vashishta B.R. Botany for degree students Pteridophytes.
14. Gurucharan Singh 2005- Plant systematics 8. Naik V.N. - Taxonomy of Angiosperms. 9. Shivrajan V.V. -Introduction to Principles plant taxonomy
15. <https://britannica.com/science/algae/classification-of-algae>
16. <https://www.greeksforgreeks.org/kingdom-fungi/>
17. <https://britannica.com/plants/bryophytes>

First Year B. Sc. Botany Semester- I
OE- 1 Course Code: BO-113
Course Title: Plant Nursery and Management

OE-1 Course [Lectures: 30] [2T]
BO-111 Plant Nursery and Management

Course objectives:

1. To provide knowledge about basic concepts and principles of nursery techniques.
2. To impart basic and technical knowledge on nursery management for strengthening of horticulture sector.
3. To study the disease and pest controlling nursery with practical experience.
4. To help students to study marketing and management relating to nursery.
5. To help students to manage nurseries and propagate healthy plants on a commercial scale.
6. To improve knowledge of greenhouse, Polyhouse, Vertical farming and hydroponics.
7. To impart entrepreneurship skill in nursery management among the students.

Course outcomes:

1. Understand the importance of a plant nursery and basic infrastructure to establish it.
2. Explain the basic material, tools and techniques required for nursery.
3. Demonstrate expertise related to various practices in a nursery.
4. Comprehensive knowledge and skills to get an employment or to become an entrepreneur in plant nursery sector.
5. To know green house and polyhouse technology.
6. To know vertical farming, Hydroponic technique.

Unit 1	<p>Plant nursery</p> <p>1.1 Introduction, definition and importance.</p> <p>1.2 Types of nurseries:</p> <p style="margin-left: 20px;">a. Temporary: Features, Advantages and disadvantages.</p> <p style="margin-left: 20px;">b. Permanent:</p> <p style="margin-left: 40px;">I. Features, Advantages and disadvantages.</p> <p style="margin-left: 40px;">II. Ornamental, Vegetable, Fruit plant, Forest plant, Open field and High-tech nurseries.</p> <p>1.3 Selection of place, lay out and components of a good nursery.</p> <p>1.4 Important role of nursery in horticulture development</p>	04 L
Unit 2	<p>Nursery: Basic requirement and setup.</p> <p>2.1 Nursery beds–types and precautions to be taken during preparation.</p> <p>2.2 Growing media, nursery tools and implements, and containers in brief.</p> <p>2.3 Soil and seed treatments, sowing of seeds and planting material used for nursery.</p>	05 L

Unit 3	<p>Plant Propagation Technique</p> <p>2.1 Plant Propagation: Introduction A. Sexual propagation: Advantages and dis-advantages B. Asexual propagation: Advantages and dis-advantages. Cutting: Root, Stem and leaf cutting Layering: Simple and Air layering (Gootee) Budding: T and Patch budding Grafting: Whip and tongue grafting.</p> <p>2.2 Green house and Polyhouse: Types and importance</p>	05 L
Unit 4	<p>Nursery: Management practices</p> <p>3.1 Potting and repotting, application of manures and fertilizers. 3.2 Plant bio-regulators and growth retardants, Water quality and management. 3.3 Common diseases, pests, care and management of nursery plants. 3.4 Seasonal activities and routine operations in a nursery. 3.5 Common possible errors in nursery activity. 3.6 Bureau of Indian Standards(BIS-2008) related to nursery. 3.7 Economics of nursery development, pricing and record maintenance. 3.8 Packing, transport, Branding and marketing of nursery plants. 3.9 Entrepreneurship development through nursery.</p>	10 L
Unit 5	<p>Vertical farming and Hydroponics</p> <p>4.1 Vertical Farming: Introduction, scope and importance. 4.2 Plants suitable for vertical farming. 4.3 Advantages of vertical farming. 4.4 Hydroponics: Introduction, scope and importance. 4.5 Basic concepts and designs, Importance of light, temperature and humidity. Nutrient film technique (NFT) 4.6 Advantages and Plants suitable for hydroponics.</p>	06 L

Suggested readings:

1. Bose, T.K. Sanyal, Dand Sandhu, M.L. (1998) Propagation of Horticultural crops. Naya Prakash Publishers, Kolkatta.
2. K.K. Nanda and V.K. Kochhar (1985). Vegetative propagation of plants. Kalyani Publisher-NewDelhi-Ludhiana.
3. Kunte, Y.N., Kawthalkar, M.P.and Yawalkar, K.S. (2005). Principles of Horticulture and Fruit Growing. Agri-Horticultural Publishing House, Nagpur.
4. Rahudkar W.B., Bhujbal B.G.,Madhuri Sonawane, Hemraj Rajput ,(2010), CMOU, Text book Publication No. AGR 227Horticulture Nursery Management.
5. Randhawa G.S., A. Mukhopadhyay (2001). Floriculture in India. Book published by Allied Publishers Limited, New Delhi
6. Ratha Krishnan, P. Kalia Rajwant K. Tewari, J.C., Roy M.M., (2014).Plant Nursery Management: Principles and Practices, Central Arid Zone Research Institute

(I.C.A.R)Jodhpur

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8. Sharma, R.R.(2002). Propagation of Horticultural Crops (Principles and practices).
9. Sharma, R. R. and Krishna, H.(2013). A text book of plant propagation and nursery management. Intl Book Distributing Co., Lucknow.
10. Andy Jacobson: Hydroponic Gardening Guide to Grow Fruit, Vegetables and Herbs at Home
11. Keith Roberto: How to Hydroponics 4th Edition.
12. Dr J. Benton Jones: Hydroponics: A Practical Guide for the Soilless Grower (2nd Edition).
13. John Mason: Commercial Hydroponics.

First Year B. Sc. Botany Semester- II

DSC- 3 Course Code: BO-121

Course Title: Plant Morphology

DSC- 3 Major (Core) Course [Lectures: 30][2T]

BO-121 Plant Morphology

Course objectives:

1. To understand concept of "plant morphology".
2. To learn technical terms to describe morphological features.
3. To understand external morphological structure and function of flowers
4. To understand structure of the fruit.

Course outcomes:

1. After completion of the course, student will be able to:
2. Understanding of plant morphology terminologies and identifying morphological peculiarities.
3. Understand plant morphology
4. Understand basics of floral morphology
5. Understand basics various plant tissues

Unit 1	Introduction to Plant Morphology 1.1 Definition of plant morphology, External and Internal Morphology. 1.2 Importance and Scope of plant morphology 1.3 Morphology of stem and root 1.3.1 Definition of stem 3.1.1 General Characteristics and types of Stems (Underground, Aerial and Subaerial stem.) 3.1.2 Function of stem 1.3.2 Definition of root 3.2.1 General Characteristics and types of roots. (tap and Adventitious root) 3.2.2 Function of roots.	05 L
Unit2	Morphology of leaf, Inflorescences and flower 2.1 Definition of leaf and parts of a leaf. 2.1.1, Types of leaves(Simple and compound leaves) 2.1.2 Venation 2.1.3 Phyllotaxy 2.1.4 Functions of leaves 2.2 Definition and its types of inflorescences (Racemose & Cymose) 2.3 Definition and part of typical Flower. 2.3.1 Types of flowers 2.3.2 Functions of Flowers	05 L

Unit3	Morphology of Fruit 3.1 Definition of fruit and part of fruit. 3.2 Types of Fruit (Simple, Aggregate and Composite)	5 L
Unit-4	The cell 4.1 Definition of cell. 4.2 Structure of plant cell. 4.3 Type of cell. 4.4 Functions of plant cell.	5 L
Unit -5	Plant tissues 5.1 Definition of Plant tissues 5.2 Types of Plant tissue 5.1.1 Meristematic tissue and its types (Promeristem, Primary Meristem and Secondary Meristem) 5.1.2 Permanent tissue and its types (simple and its type, Complex tissue and its type)	5 L

Suggested readings:

1. Coutler E. G. , 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
2. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
3. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
4. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
5. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
6. Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
7. Nair P .K .K - Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
8. Pandey S.N. 1997, Plant Anatomy and Embryology .A. Chadha, Vikas Publication House Pvt Ltd;
9. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi
10. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands. .
11. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi
12. Vashishta .P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar
13. Vashishta, P.C. 1997. Plant Anatomy, Pradeep Publications
14. Online Resources : https://onlinecourses.nptel.ac.in/noc19_bt17/preview

First Year B. Sc. Botany Semester- II

DSC- 4 Course Code: BO-122

Course Title: Laboratory- 1 Practical based on BO-121

DSC- 4 Major (Core) Course [Lectures: 60][2T]

Course Title: Laboratory- 1 Practical based on BO-121

Course objectives:

1. To understand concept of plant morphology.
2. To learn technical terms to describe morphological features.
3. To understand external morphological structure and function of flowers
4. To understand structure of the fruit.

Course outcomes:

1. After completion of the course, student will be able to:
2. Understanding of plant morphology terminologies and identifying morphological peculiarities.
3. Understand plant morphology
4. Understand basics of floral morphology
5. Understand basics various plant tissues

Practical-1&2	Study of stem and its type (Underground stem, Aerial stem and Subaerial stem.)
Practical-3	Study of root and its type (tap and adventitious)
Practical-4	Study of parts of a leaf.
Practical-5	Study of types of venation.
Practical-6	Study of types of leaf (Simple, Compound)
Practical-7	Study of meristems (through permanent slides and photographs)
Practical-8&9	Study of permanent simple tissue (parenchyma, collenchyma and sclerenchyma) any two ((through permanent slides and photographs)
Practical-10	Study of flower typical flower and its parts(Hibiscus / Datura)
Practical-11	Study of Racemose type of inflorescences
Practical-12	Study of Cymose type of inflorescences
Practical-13	Study of Simple fruits (Apple/ banana/ tomato)
Practical-14	Study of Aggregate fruits (blackberries / strawberries / custard)
Practical-15	Study of Composite fruits (mulberry/peepal,/banyan)

Suggested readings:

1. Practical Manual of Plant Morphology by S. Sundara Rajan, this book was published in 2003.
2. A Textbook of Practical Botany II
3. "Textbook of Botany" by Singh, Pandey, and Jain - This widely used textbook covers various aspects of botany, including plant morphology, authored by Indian botanists.
4. "Plant Anatomy and Embryology" by B.P. Pandey - Although it focuses on anatomy and embryology, this book also touches upon aspects of morphology.
5. "Practical Botany" by Dr. S. K. Jain - While not solely focused on morphology, this book includes practical exercises covering various aspects of botany, which likely include morphology.
6. "Textbook of Botany: Diversity of Microbes and Cryptogams" by S. P. Jain and S. K. Sharma - This textbook covers a wide range of botanical topics, including plant morphology.

First Year B. Sc. Botany Semester- II

OE-2 Course Code: BO-123

Course Title: Food Technology

OE- 2 Major (Core) Course [Lectures: 60][4T]

Course Title: Food Technology

Course objectives:

1. To impart knowledge of various areas related to Food Science and Technology.
2. To enable the students to understand food composition and its physicochemical, and nutritional, aspects of food Science.
3. To familiarize the students with the processing and preservation techniques of food Product.
4. To emphasize the importance of food safety, food quality, food plant.
5. To enable the students to understand food processing technologies and product.
6. To learn and innovate the Ideal methods of food Preparation, Processing, Storage also to conserve the nutritive values of food product.
7. To maintain the quality and safety of food.

Course outcomes:

1. Students will demonstrate knowledge of various properties of food and its application in food industry,
2. Students will understand the Concept of food processing, conventional and advanced methods of food preservation.
3. Students will learn Methods of packing, & develop food products and for food industry.

Unit 1	Introduction to Food Science 1.1 Different Kinds of Food Industries, 1.2 Components of Food Industries. 1.3 Scope of food processing and technology, Food constituents: 1.4 Carbohydrates, lipids, proteins, vitamins and minerals, water. 1.5 Nutritional and chemical properties of food constituents and their function.	12 L
Unit 2	Introduction to Food Preservation Techniques. 2.1 Define Pasteurization, Sterilization, Ultra High temperature, Blanching, etc. 2.2 Low-temperature preservation techniques: Cooling, Evaporation, refrigeration, and freezing. 2.3 Canning (definition, time-temperature combination and equipments) 3.2. Packaging (Introduction, Metal Containers, Glass Containers, Rigid Plastic Containers, Restorable Pouches).	12 L

Unit 3	Food preservation Physical & Chemical Methods 3.1 Definition of chemical preservatives and types. 3.2 Physical (Morphological) & Chemical Properties of Milietes. 3.3 Introduction to new techniques in preservation of food like High Pressure processing, Ohmic heating, Pulse electric field processing, Irradiation Shelf Life, Packaging and Labeling etc.	12 L
Unit 4	Basic introduction to unit operation in Food Processing 4.1 Define the term Cleaning, dry cleaning methods ,wet cleaning methods 4.2 Peeling 4.3 Grading and sorting.	12 L
Unit -5	Food Products 5.1 Food Products: Methods of Preparation of Jam, Jelly, Marmalade, Banana Ketchup Recipe, Sun drying of Potatoes. 5.2 Drying and their importance in the food processing.	12 L

Suggested readings:

1. Food Science by Norman N Potter and Joseph H. Hotchkiss, CBS Publishers and Distributors.
2. Advanced Textbook on Food and Nutrition by Dr. M. Swaminathan Vol: I & II, The Bangalore Printing and Publishing Co. Ltd.
3. Food Science by Norman N Potter and Joseph H. Hotchkiss, CBS Publishers and Distributors.
4. Food Science by Norman N Potter and Joseph H. Hotchkiss, CBS Publishers and Distributors.
5. Advanced Textbook on Food and Nutrition by Dr. M. Swaminathan Vol: I & II, The Bangalore Printing and Publishing Co. Ltd.
6. Food Facts and Principles Many N. S. & Shadaksha Swamy M. New Age International Publishers.
7. Bawa. A. S, O. P Chauhan et al. Food Science. New India Publishing agency, 2013.
8. Roday, S. Food Science, Oxford publication, 2011.
9. B. Srilakshmi, Food Science, New Age Publishers, 2002.
10. Meyer, Food Chemistry, New Age, 2004.
11. De Sukumar., Outlines of Dairy Technology, Oxford Uni. Press, 2007.
12. KHAN M. R. Horticulture & Gardening, Nirali Publication, Pune, 1995.