

Fergusson College (Autonomous), Pune

## Department of Botany

### Semester III Course Structure

Semester	Paper Code	Theory/ Practical	Paper Title	Credits
<b>III</b>	<b>BOT-200 (MAJOR)</b>	Practical	Botany Practical III	2
	<b>BOT-201 (MAJOR)</b>	Theory	Plant Physiology and Economic Botany	4
	<b>BOT-211 (MINOR)</b>	Theory	Fundamentals of Plant Physiology and Economic Botany	2
	<b>BOT -212 (MINOR)</b>	Practical	Botany Practical III	2
	<b>BOT-220 (OE-V)</b>	Theory	Kitchen Gardening	2
	<b>BOT-230 (VSC)</b>	Theory	Mushroom Cultivation	2
	<b>BOT-240 (SEC)</b>	Theory	Herbal Cosmetics	2
	<b>BOT-245 (CEP)</b>		Foundations of Community Engagement	2

### Semester IV Course Structure

Semester	Paper Code	Theory/ Practical	Paper Title	Credits
<b>IV</b>	<b>BOT-250 (MAJOR)</b>	Practical	Botany Practical IV	2
	<b>BOT-251 (MAJOR)</b>	Theory	Plant Taxonomy and Ecology	4
	<b>BOT-261 (MINOR)</b>	Theory	Fundamentals of Plant Taxonomy and Ecology	2
	<b>BOT-262 (MINOR)</b>	Practical	Botany Practical IV	2
	<b>BOT-270 (OE)</b>	Theory	Fruit and Vegetable Processing	2
	<b>BOT-280 (VSC)</b>	Theory	Nursery and Gardening	2
	<b>BOT-290 (SEC)</b>	Theory	Plant Tissue Culture	2
	<b>BOT-295 (FP)</b>		Community Engagement - Field Project	2

S. Y. B. Sc. Semester III		
<b>BOT-201</b>	<b>Plant Physiology and Economic Botany</b>	<b>Credits: 04</b>
	<b>S. Y. (Major Semester III)</b>	<b>Hours: 60</b>
	<b>Course Outcomes (COs)</b>	<b>Bloom's</b>
<b>BOT- 200</b>	<b>Botany Practical III (Major Practical)</b>	<b>Credits:02 Hours:30</b>
	<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>	<b>Bloom's cognitive level</b>
CO1	Recall the physiological phenomenon.	1
CO2	Interpret the role of Diffusion Pressure Deficit, effect of light on rate of transpiration and stomatal frequency.	2
CO3	Examine the significance of economically important plants.	3
CO4	Identify the presence of starch, protein, cellulose using micro-chemical tests.	4

Any 12 experiments: 10 compulsory + 1 Activity (Equivalent to Two Practical)

<b>Practical No.</b>	<b>Title of the Practical</b>
1.	Determination of Diffusion Pressure Deficit (DPD) using potato tuber.
2.	To study the effect of the environmental factor light on transpiration by excised twig.
3.	Study of plasmolysis in suitable plant material.
4.	Calculation of stomatal frequency and stomatal index in suitable plant material.
5.	Determination of diurnal fluctuation in TAN values of CAM plants.
6.	Demonstration Experiments: Imbibition in seeds, Osmosis-curling experiment, Role of N/ P / K on growth of plants, Effect of auxins on rooting, Symbiotic nitrogen fixation using root nodules.
7.	Study of Cereals and Legumes. Cereals: Wheat, Millets and Pseudocereals ( <i>Amaranth</i> Grain), Legumes: Chickpea Micro-chemical test for protein.
8.	Study of Sugar yielding plants. Sugarcane and Potato, Micro-chemical test for starch.
9.	Study of Oil and Fibre Yielding Plants. Fatty Oils: Groundnut, Essential Oils: Eucalyptus, Fibres: Cotton, Micro-chemical test for cellulose
10.	Demonstration of Spices and Beverages. Spices: Clove, Black pepper, Turmeric, Cumin; Beverages: Tea
11.	Demonstration of Medicinal and Fumigatory Plants. <i>Adathoda</i> and Tobacco
12.	Visit to traditional oil extraction plant/vegetable processing unit/ Demonstration of Modern vegetables Bell pepper, cherry tomato.

<b>On completion of the course, the students will be able to:</b>		<b>cognitive level</b>
CO1	Recall the concepts in plant physiology and economic botany.	1
CO2	Interpret the physiological processes and explain the morphology and production of economically important plants.	2
CO3	Apply knowledge to describe physiological mechanisms and economic uses of plant resources with examples.	3
CO4	Analyze the significance of physiological phenomenon and processing methods in plants.	4

<b>Unit No.</b>	<b>Title of Unit and Contents</b>	<b>No. of hours</b>
<b>I</b>	<b>Plant-water relations</b> Physical properties of water, Importance of water in plant life, Diffusion, Osmosis (definition, mechanism), types of solutions (hypotonic, hypertonic and isotonic, endosmosis and exosmosis), concept of osmotic pressure (OP), turgor pressure (TP), wall pressure (WP), relation between OP, TP and DPD, significance of osmosis, Plasmolysis (definition, mechanism, deplasmolysis, significance), Imbibition (definition, mechanism, imbibition pressure, significance), Absorption of water (root hair as water absorbing part of plant), ascent of sap (cohesion- tension theory)	<b>05</b>
<b>II</b>	<b>Transpiration</b> Definition, types of transpiration, structure of stomata, opening and closing mechanism of stomata (starch-sugar hypothesis, proton transport theory), factors affecting rate of transpiration, significance of transpiration, antitranspirants, guttation.	<b>04</b>
<b>III</b>	<b>Mineral nutrition and Phloem translocation</b> Essential and beneficial elements, macro- and micronutrients, criteria of essentiality of elements, methods of studying mineral requirement (Solution Culture-Hydroponics and Aeroponics,), role and mineral deficiency symptoms of N, P and K. <b>Phloem translocation:</b> Composition of phloem sap, girdling experiments, Pressure Flow Model, phloem loading and unloading.	<b>05</b>
<b>IV</b>	<b>Plant growth regulators, photoperiodism and vernalization</b> Discovery, chemical nature (basic structure, precursor), commercial applications of Auxins, Gibberellins, Cytokinins, Abscisic Acid, Ethylene. Photoperiodism, discovery, classification of plants based on photoperiod, concept of florigen, phytochrome, vernalization (concept mechanism, applications).	<b>05</b>
<b>V</b>	<b>Carbon metabolism</b> Photosynthetic pigments (chlorophyll a and chlorophyll b, xanthophyll, carotene); photosystem I and II, Light reactions (electron transport and photophosphorylation), Dark reactions: C <sub>3</sub> pathway; C <sub>4</sub> and CAM pathways (no chemical structures); photorespiration.	<b>06</b>

VI	<b>Respiration:</b> aerobic and anaerobic respiration, Glycolysis, Krebs Cycle; oxidative phosphorylation and ATP synthesis; Pentose Phosphate Pathway	05
VII	<b>Origin of Cultivated Plants</b> Importance of Plant Resources; Vavilov's concept for the Origin of cultivated plants; Centre's of Origin (Primary and Secondary); Harlan's concept of gene pools.	02
VIII	<b>Cereals and Legumes</b> <b>Cereals:</b> Wheat (Origin, Evolution of Wheat (tetraploid & hexaploid), Morphology, Production, and uses of Hexaploid Wheat) Other cereals: Rice, Maize, Barley, Oats, Millets (jowar, bajra, ragi) and Pseudocereals ( <i>Amaranth</i> Grain). <b>Legumes:</b> General account and nutritive value, chick pea and pigeon pea (Morphology, Production and Uses). Other Legumes: Lentil, Cluster Bean, Pea and Cowpea.	05
IX	<b>Sugar</b> Sugarcane (Morphology, Production, Products and By- products); Potato (Morphology, Production and Uses).	04
X	<b>Oil and Fibre Yielding Plants</b> <b>Oil:</b> General account, Fatty Oils (Classification with examples), Essential Oils (General characteristics, Methods of Extraction and Economic Importance), Differences between fatty oils and essential oils; Groundnut and <i>Eucalyptus</i> (Morphology, Production and Uses). Other examples: Sunflower, Soybean, Sandalwood and Lemongrass <b>Fibre:</b> Classification of Fibres based on their origin (surface fibres, bast fibres, and leaf fibres, with examples); Cotton (Morphology, Processing and Uses). Other examples: Jute, Flax, Hemp and Coconut	05
XI	<b>Spices and Beverages</b> <b>Spices:</b> General account and importance (Spices, Condiments and Culinary Herbs, with examples), Clove and Black Pepper (Morphology, Production and Uses) Other examples: Turmeric, Cardamom, Red Chilli, Fennel, Coriander and Cumin. <b>Beverages:</b> Types of Beverages (Alcoholic and Non-Alcoholic) with examples, Tea (Morphology, Processing and Uses)	05
XII	<b>Medicinal, Fumigatory and Masticatory Plants</b> General account with examples, <i>Rauwolfia</i> and <i>Adathoda</i> (Morphology, Chemical constituents and Uses), Tobacco and Betel palm (Morphology, Processing, Products and health hazards)	05
XIII	<b>Rubber</b> Para Rubber - <i>Hevea brasiliensis</i> (Morphology, Processing, Products and uses)	02
XIV	<b>Modern vegetables</b> Introduction to exotic vegetables and their uses, (broccoli, bell pepper, cherry tomato and lettuce)	02

## S. Y. B. Sc. Semester III

### Learning Resources:

Reference Books	<ol style="list-style-type: none"><li>1. Devlin, R.M. And F.H. Witham. (1983). Plant Physiology. Willard Grant Press. U.S.A.</li><li>2. Moore, T.C. (1979). Biochemistry and Physiology of Plant Hormones. Springer- Verlag. Berlin.</li><li>3. Jain, V.K. (2000). Fundamentals Of Plant Physiology, S. Chand &amp;Co, New Delhi.</li><li>4. Pandey, S.N. (1991): Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India.</li><li>5. Verma, V. (2007). Text Book of Plant Physiology, Ane Books India, New Delhi.</li><li>6. Nobel, P.S. (2009). Physicochemical and Environmental Plant Physiology.4th edition Academic Press, UK</li><li>7. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.</li><li>8. Salisbury F.B. and Ross C.B. (2005). Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.</li><li>9. Helgi Opik, Stephen A. Rolfe, Arthur J. Willis. (2005). The Physiology of Flowering Plants, Cambridge University Press, UK</li><li>10. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley &amp; Sons, U.S.A. 4th Edition.</li><li>11. Verma V. (2009). Textbook of Economic Botany, Ane Books Pvt. Ltd.</li><li>12. Kochhar, S.L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan &amp; Co.</li><li>13. Kochhar, S.L. (2016). Economic Botany – A Comprehensive Study, 5th Edition. New Delhi, India: Cambridge University Press.</li><li>14. Wickens, G.E. (2001). Economic Botany: Principles &amp; Practices. The Netherlands: Kluwer Academic Publishers.</li></ol>
E-resources	<p><a href="https://egyankosh.ac.in">https://egyankosh.ac.in</a></p> <p><a href="https://www.swayamprabha.gov.in">https://www.swayamprabha.gov.in</a></p>

<b>BOT-211</b>	<b>Plant Physiology and Economic Botany (Minor Theory)</b>	<b>Credits: 02 Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Memorize the concepts of plant physiology and economic botany.	1
CO2	Discuss the physiological processes and explain the morphology and production of economically important plants.	2
CO3	Interpret the physiological mechanisms and economic uses of plant resources with examples.	3
CO4	Distinguish the importance of physiological phenomenon and processing methods in plants.	4

<b>Unit No.</b>	<b>Title of Unit and Contents</b>	<b>No. of hours</b>
<b>I</b>	<b>Plant-water relations</b> Importance of water in plant life. Diffusion, Osmosis, types of solutions (hypotonic, hypertonic and isotonic, endosmosis and exosmosis), concept of osmotic pressure (OP), turgor pressure (TP), wall pressure (WP), significance of osmosis. Plasmolysis and deplasmolysis, Imbibition (definition, mechanism and significance).	<b>02</b>
<b>II</b>	<b>Transpiration</b> Definition, types of transpiration, opening and closing mechanism of stomata (starch-sugar hypothesis), significance of transpiration, antitranspirants, guttation.	<b>02</b>
<b>III</b>	<b>Mineral nutrition</b> Essential and beneficial elements (macro- and micronutrients), methods of studying mineral requirement (Solution Culture-Hydroponics and Aeroponics), role and mineral deficiency symptoms of N, P and K.	<b>02</b>
<b>IV</b>	<b>Plant growth regulators</b> Discovery, chemical nature (basic structure, precursor), commercial applications of Auxins, Cytokinins and Gibberellins.	<b>02</b>
<b>V</b>	<b>Plant response to light and temperature</b> Photoperiodism, classification of plants based on photoperiod, Concept of phytochrome. Vernalization (concept, mechanism, applications).	<b>02</b>
<b>VI</b>	<b>Carbon metabolism</b> Photosynthetic pigments; photosystem I and II. Light reactions- photophosphorylation (cyclic and non-cyclic) Dark reactions: C3 pathway and C4 pathways. Introduction to CAM plants.	<b>05</b>
<b>VII</b>	<b>Introduction and Origin of Cultivated Plants</b> Importance of Plant Resources; Vavilov's concept for the Origin of cultivated plants; Centers of Origin (Primary and Secondary).	<b>01</b>

<b>VIII</b>	<p><b>Cereals and legumes</b> Wheat (Origin, Evolution of Wheat (tetraploid &amp; hexaploid), Morphology, Production, and uses of Hexaploid Wheat) Other cereals: Maize, Wheat, Oats, Millets (jowar, bajra, ragi) and Pseudocereals.</p> <p><b>Legumes</b> General account and nutritive value Chickpea (Morphology, Production and Uses). Other Legumes: Lentil, Cluster Bean, Cow pea.</p>	<b>04</b>
<b>IX</b>	<p><b>Sugar</b> Sugarcane -Morphology, Production, Products and By-products.</p>	<b>01</b>
<b>X</b>	<p><b>Oil and fibre -yielding Plants</b> General account, Fatty Oils (Classification with examples), Essential Oils (General characteristics, Methods of Extraction and Economic Importance), Differences between fatty oils and essential oils, Groundnut and <i>Eucalyptus</i> (morphology, production and uses). Other examples: Sunflower, Lemongrass. <b>Fibre:</b> Classification of Fibres based on their origin (surface fibres, bast fibres, and leaf fibres, with examples); Cotton (Morphology, Processing and Uses).</p>	<b>04</b>
<b>XI</b>	<p><b>Spices and beverages</b> General account and importance (Spices, Condiments and Culinary Herbs, with examples), Clove (morphology of part used and uses) Other examples: Turmeric, Cumin and Fennel. <b>Beverages:</b> Types of Beverages (Alcoholic and Non-Alcoholic) with examples, Tea (morphology, processing and uses)</p>	<b>04</b>
<b>XII</b>	<p><b>Modern vegetables</b> Introduction to exotic vegetables and their uses, (broccoli, bell pepper, cherry tomato and lettuce)</p>	<b>01</b>

### Learning Resources:

Reference Books	<ol style="list-style-type: none"> <li>1. Jain, V.K. (2000). Fundamentals of Plant Physiology, S. Chand &amp;Co, New Delhi.</li> <li>2. Pandey, S.N. (1991): Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India.</li> <li>3. Verma, V. (2007). Text Book of Plant Physiology, Ane Books India, New Delhi.</li> <li>4. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.</li> <li>5. Salisbury F.B. and Ross C.B. (2005). Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.</li> <li>6. Verma V. (2009). Textbook of Economic Botany, Ane Books Pvt. Ltd.</li> <li>7. Kochhar, S.L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan &amp; Co.</li> <li>8. Kochhar, S.L. (2016). Economic Botany – A Comprehensive</li> </ol>
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	Study, 5th Edition. New Delhi, India: Cambridge University Press. 9. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers.
E-resources	<a href="https://egyankosh.ac.in">https://egyankosh.ac.in</a> <a href="https://www.swayamprabha.gov.in">https://www.swayamprabha.gov.in</a>

Any 12 experiments: 10 compulsory + 1 Activity (Equivalent to Two Practical)

S. Y. B. Sc. Semester III		
<b>BOT-212</b>	<b>Plant Physiology and Economic Botany Practical (Minor Practical)</b>	<b>Credits: 02 Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Recall the physiological phenomenon.	1
CO2	Interpret the role of Diffusion Pressure Deficit, effect of light on rate of transpiration and stomatal frequency.	2
CO3	Examine the significance of economically important plants.	3
CO4	Identify the presence of starch, protein, cellulose using micro-chemical tests.	4

<b>Practical No.</b>	<b>Title of the Practical</b>
1.	Determination of Diffusion Pressure Deficit (DPD) using potato tuber.
2.	To study the effect of the environmental factor light on transpiration by excised twig.
3.	Study of plasmolysis in suitable plant material.
4.	Calculation of stomatal frequency and stomatal index in suitable plant material.
5.	Determination of diurnal fluctuation in TAN values of CAM plants.
6.	Demonstration Experiments: Imbibition in seeds, Osmosis-curling experiment, Role of N/ P / K on growth of plants, Effect of auxins on rooting, Symbiotic nitrogen fixation using root nodules.
7.	Study of Cereals. Cereals: Wheat, Millets and Pseudocereals ( <i>Amaranth</i> Grain).
8.	Study of Legumes- Chickpea. Micro-chemical test for protein.
9.	Study of Sugar yielding plant-Sugarcane.
10.	Study of Oil and Fibre Yielding Plants. Fatty Oils: Groundnut, Essential Oils: Eucalyptus, Fibres: Cotton, Micro-chemical test for cellulose
11.	Demonstration of Spices and Beverages. Spices: Clove, Black pepper, Turmeric, Cumin; Beverages: Tea



12.	Visit to traditional oil extraction plant/vegetable processing unit/ Demonstration of Modern vegetables Bell pepper, cherry tomato.
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<b>S. Y. B. Sc. Semester III</b>		
<b>BOT-220</b>	<b>Kitchen gardening (OE V)</b>	<b>Credits: 02 Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Define and recall key terms related to kitchen gardening and identify different types of vegetables for planting.	1
CO2	Explain components of kitchen garden and understand stages from seed germination to harvest.	2
CO3	Demonstrate planting techniques and apply knowledge of companion planting to maximize garden productivity.	3
CO4	Evaluate components of kitchen gardening for plant health and analyze pest and disease symptoms.	4

<b>Unit No.</b>	<b>Title of Unit and Contents</b>	<b>No. of hours</b>
<b>I</b>	<b>Introduction to kitchen gardening.</b> Concept, Objectives, Importance, Morphology.	<b>04</b>
<b>II</b>	<b>Planning of kitchen gardening</b> Types of kitchen garden, Components of kitchen gardening, selecting suitable plants for kitchen gardening, Designing and Landscaping of kitchen garden layout	<b>05</b>
<b>III</b>	<b>Classification of vegetables</b> Underground vegetables, Herbage, Fruit vegetables	<b>02</b>
<b>IV</b>	<b>Root vegetable</b> Habit, cultivation and nutritive value (Carrot, Raddish, Beet root, Taro)	<b>03</b>
<b>V</b>	<b>Stem vegetable</b> Habit, cultivation and nutritive value (Onion, Garlic, Ginger, Corn)	<b>03</b>
<b>VI</b>	<b>Leaf vegetable</b> Habit, cultivation and nutritive value (Coriander, Spinach, Fenugreek, Mentha)	<b>04</b>
<b>VII</b>	<b>Fruit vegetable</b> Habit, cultivation and nutritive value (Tomato, Chilli, Brinjal, Lady finger)	<b>03</b>
<b>VIII</b>	<b>Other plants in kitchen garden</b> Habit, cultivation and nutritive value (French beans, Bottle gourd, Cauliflower, Peas)	<b>04</b>
<b>IX</b>	<b>Protection from Pests and Diseases</b>	<b>02</b>

## Learning Resources:

Reference Books	<ol style="list-style-type: none"> <li>1. Pandey B. P. (1995) Economic Botany. S. Chand &amp; Company Ltd. New Delhi.</li> <li>2. Nanda, K.K. and Kochar V.K. (1985). Vegetative Propagation of Plants. Kalyani Publishers, New Delhi.</li> <li>3. Pandey B. P. (1995) Economic Botany. S. Chand &amp; Company Ltd. New Delhi.</li> <li>4. Smith, Edward C. (2009). The Vegetable Gardener's Bible. Storey Publishing.</li> <li>5. Bartholomew, Mel. (2006). Square Foot Gardening, Cool Springs Press.</li> <li>6. Riotte, Louise (1998). Carrots Love Tomatoes: Secrets of Companion Planting for successful Gardening. Storey Publishing.</li> <li>7. Martin, Deborah L. (2015). Rodale's Basic Organic Gardening: A Beginner's Guide to Starting a Healthy Garden. Rodale Books.</li> </ol>
E-resources	<a href="https://hortnet.gov.in/">https://hortnet.gov.in/</a> <a href="https://www.iihr.res.in/">https://www.iihr.res.in/</a> <a href="https://www.greenmylife.in/">https://www.greenmylife.in/</a>

S. Y. B. Sc. Semester III		
<b>BOT- 230</b>	<b>Mushroom Cultivation (VSC)</b>	<b>Credits: 02 Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Understand the process and steps involved in mushroom production, culture media, spawn and compost preparation.	1
CO2	Classify different types of mushrooms and evaluate its nutrition and storage methodology.	2
CO3	Analyze the economics of mushroom cultivation	3
CO4	Apply the knowledge of mushroom cultivation for self-employment.	4

Unit No.	Title of Unit and Contents	No. of hours
<b>Unit I</b>	<b>Introduction to Mushrooms</b> Introduction, history, scope of mushroom cultivation Edible mushrooms and Poisonous Mushrooms. Edible mushrooms available in India: <i>Volvariella volvacea</i> , <i>Pleurotus citrinopileatus</i> , <i>Agaricus bisporus</i> .	<b>5</b>
<b>Unit II</b>	<b>Cultivation Technology</b> Infrastructure, Sterilization of substrates (locally available). Spawn production, culture media preparation, production of pure culture, mother spawn and multiplication of spawn.	<b>10</b>

**S. Y. B. Sc. Semester III**

<b>BOT - 240</b>	<b>Herbal Cosmetics (SEC)</b>	<b>Credits: 02 Hours: 30</b>
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	Composting technology, mushroom bed preparation. Spawning, harvesting.	
<b>Unit III</b>	<b>Nutrition and Food Preparation</b> Nutrient profile- Proteins, amino acids, calorific value, carbohydrates, fats, vitamins & mineral, Nutritional and medicinal value of edible mushrooms, Health benefits of mushrooms, Types of foods prepared from mushroom.	<b>6</b>
<b>Unit IV</b>	<b>Post-harvest technology</b> Post-harvest technologies like packaging and preservation of mushrooms- Freezing, drying, canning, quality assurance and entrepreneurship, Value added products of mushrooms, Government policies related to the promotion of mushroom cultivation.	<b>5</b>
<b>Unit V</b>	Visit to an Institute or Centre conducting mushroom cultivation (Report to be submitted).	<b>4</b>

**Learning Resources:**

Reference Books	<ol style="list-style-type: none"> <li>Bahl, N. (2015). Hand Book on Mushroom. Oxford &amp; IBH Publishing Company.</li> <li>Chang, S.T., Miles, P.G. (2004) Mushrooms Cultivation, Nutritional Value, Medicinal effect and Environmental Impact, CRC Press.</li> <li>Kannaiyan S. &amp; Ramasamy K. (1980). A hand book of edible mushroom, Today &amp; Tomorrows printers &amp; publishers, New Delhi.</li> <li>Marimuthu, T., Krishnamoorthy, A. S., Sivaprakasam, K. and Jayarajan, R. (1991), Oyster mushrooms, Department of Plant Pathology, Tamil Nadu, Agricultural University, Coimbatore.</li> <li>Pathak Yadav Gour (2010). Mushroom Production and Processing Technology, Published by Agrobios (India).</li> <li>Rai, R.D., Arumuganathan, Y. (2008). Post Harvest Technology of Mushrooms. National Research Center for Mushroom (Indian Council of Agricultural Research) Chambaghat, Solan (HP)</li> <li>Russell, S. (2014). The Essential Guide to Cultivating Mushroom. Storey Publishing. North Adams, M.A. 01247</li> <li>Singh, M., Vijay, B., Kamal, S., Wakchaure, G.C. (2011). Mushrooms Cultivation, Marketing and Consumption., Publishers Directorate of Mushroom Research (ICAR) Chambaghat, Solan.</li> <li>Tewari, PankajKapoor, S. C., (1998). Mushroom Cultivation, Mittal Publication, Delhi.</li> <li>Tripathi, D.P.(2005). Mushroom Cultivation, Oxford &amp; IBH Publishing Co. PVT. LTD, New Delhi.</li> <li>Zied, D. C., Gimenez, A. P. (017) Edible and Medicinal Mushroom page no. 1- 585.John Wiley &amp; Sons Ltd.UK.</li> </ol>
E-resources	<ol style="list-style-type: none"> <li><a href="https://dmrsolan.icar.gov.in/">https://dmrsolan.icar.gov.in/</a></li> <li><a href="https://www.iihr.res.in/mushroom">https://www.iihr.res.in/mushroom</a></li> </ol>

<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Learn the basics of raw material used in herbal cosmetics	1
CO2	Classify the raw material in herbal cosmetics	2
CO3	Implement the uses of herbal cosmetics	3
CO4	Selecting the raw material for herbal cosmetics	4

<b>Unit No.</b>	<b>Title of Unit and Contents</b>	<b>No. of hours</b>
<b>I</b>	Introduction: Scope, historical background, Brief history of herbal cosmetics, classification of herbal cosmetics, benefits of herbal cosmetic products.	<b>5</b>
<b>II</b>	Plants and processes used in skin care Scrub, ubtan, face packs, moisturizer	<b>5</b>
<b>III</b>	Plants and processes used in hair structure and physiology, herbal hair care cosmetics. Hair grooming: apricot, aloe Hair growth promoters: brahmi, manjistha, jatamansi. Hair tonics: Bavachi, Hibiscus, Amla Anti-dandruff: tulsi, neem, wheat germ oil, lemon, orange, aritha Hair colorants: henna, amla, bhringaraja ( <i>E. alba</i> ), chamomile Hair cleansing: ritha, shikakai, amla	<b>5</b>
<b>IV</b>	Preparation of vanishing cream, face wash, soap, moisturizer, talcum powder and sunscreen.	<b>5</b>
<b>V</b>	Preparation of tooth powder, kajal, nail polish, lipstick, lip balm, deodorant, shaving cream, and after shave lotion.	<b>5</b>
<b>VI</b>	Herbs used as antioxidants, free-radical scavenger, antiseptic, antibacterial, anti-wrinkle and anti-fungal.	<b>5</b>

### **Learning Resources:**

Reference Books	<ol style="list-style-type: none"> <li>1. Marvin Balsam, Edward Sagarin; Cosmetic Science and Technology Vol I, II, III Ed. 2nd, John Wiley &amp; Co. England</li> <li>2. Chopra RN, Indian Herbs. The Wealth of India: Raw Materials (11 Vol.+ 2 Suppl.). Head, NISCIR, Dr. K. S. Krishnan Marg, Pusa Campus New Delhi-110 012, India. 1950.</li> <li>3. Bare P., Cosmetics Analysis selective methods with techniques.</li> <li>4. Behl PN, Srivastava G. Herbs Useful in Dermatological Therapy. Ed. 2nd New Delhi, India: CBS Publishers. 2002</li> <li>5. Hand Book of herbal products Vol I &amp; II by NIIR Board of Technologist. National Institute of Industrial Research, Trease and Evans Pharmacognosy: William Charles Evans Revised with the assistance of Daphne Evans Ed. 16th Elsevier 2009</li> </ol>
e-Resources	<a href="https://www.eshiksha.mp.gov.in/mpdhe/course/view.php?id=275">https://www.eshiksha.mp.gov.in/mpdhe/course/view.php?id=275</a>

**S. Y. B. Sc. Semester III**

<b>BOT-245</b>	<b>Foundations of Community Engagement (CEP)</b>	<b>Credits: 02 Hours: 45</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Understand Community Needs.	1
CO2	Identify Project Opportunities.	2
CO3	Craft and Finalize effective Project Proposals	3
CO4	Discuss successful community engagement projects.	4

**Community engagement –Basics ( 1 Credit)**

<b>Topics Covered</b>	<b>Activities</b>
Introduction to Community Engagement	- Overview of theories and models - Importance of interdisciplinary approaches
Social Issues Analysis	- Guest lecture by a social scientist or experts from diverse sectors - Group discussion and analysis of contemporary social issues
Community Needs Assessment	- Theory on needs assessment methodologies - Field visit for practical application
Stakeholder Engagement	- Guest lecture from a community organizer - Simulated stakeholder engagement role-play

**Community engagement –Field Work ( 1 Credit)**

<b>Topics Covered</b>	<b>Activities</b>
Cultural Competence in Community Work	- Cultural sensitivity training - Case studies on community engagement
Writing Project Proposal and finance resource management	- Develop a community project proposal and finance resource management - Timeline for implementation
Field Work Skills Training	- Training in data collection, interviewing, and observation - Practical exercises in the community
Ethical Considerations in Community Engagement	- Guest lecture on ethical dilemmas in community work - Case studies and group discussions

	<b>Credit</b>	<b>Contact/ learning Hours</b>	<b>Course component</b>
Sem III	1	15 hrs.	Classroom engagement and tutorials
	1	30 (student learning hrs.)	Field Engagement (Requirement Gathering)

Class engagement: 1 Credit = 1 Hour; Field engagement/Field Project: 1 Credit = 2 Hour

<b>S. Y. B. Sc. Semester IV</b>		
<b>BOT- 252</b>	<b>Botany Practical IV (Major - Practical)</b>	<b>Credits: 2 Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		Bloom's cognitive level
CO1	List out morphological and anatomical adaptive characters in ecological grouping	1
CO2	Classifies and identifies plants up to family level	2
CO3	Interpret vegetation by List Count Quadrante method	3
CO4	Distinguish wild plants to their respective families	4

Any 12 experiments: 10 compulsory + 1 Activity (Equivalent to Two Practical)

<b>Practical No.</b>	<b>Title of the Practical</b>
1.	Study of Tools of Taxonomy – field, library and laboratory
2.	Description of plant in botanical terms.
3.	Study of plant families Leguminosae and Apocynaceae with respect to vegetative and floral characters.
4.	Study of plant families Euphorbiaceae and Amaryllidaceae with respect to vegetative and floral characters.
5.	Botanical Excursion/ Visit to Botanical Garden.
6.	Submission of digital herbarium of wild flowering plant specimens and identify them using available resources (Flora, herbaria, e-resources) and classify up to family level (according to Bentham and Hooker's classification).
7.	Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer and hygrometer.
8.	Determination of pH and dissolved oxygen from polluted and unpolluted water samples.
9.	Determination of pH and water holding capacity of two soil samples.
10.	Study of morphological adaptations of hydrophytes with any two examples.
11.	Study of morphological adaptations of xerophytes with any two examples.
12.	Quantitative analysis of herbaceous vegetation in the college campus for frequency, density, abundance and comparison with Raunkiaer's frequency distribution law

<b>S. Y. B. Sc. Semester IV</b>		
<b>BOT- 251</b>	<b>Plant Taxonomy and Ecology (Major- Theory)</b>	<b>Credits: 04 Hours: 60</b>
<b>Course Outcomes (COs) On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Describe and define basic terminologies of plant Taxonomy and Ecology	1
CO2	Differentiate and categorized Ecological Succession morphology and economic importance of families	2
CO3	Implement the knowledge of plant nomenclature and Ecosystem Ecology	3
CO4	Identify and classify different families and ecological adaptations	4

<b>UnitNo.</b>	<b>Title of Unit and Contents</b>	<b>No. of hours</b>
<b>I</b>	<b>Introduction to Plant Taxonomy</b> Concept of Taxonomy and Systematics, Definition, scope and objectives of taxonomy, Identification, classification and nomenclature	<b>03</b>
<b>II</b>	<b>Identification</b> Functions of Herbarium, List of important herbaria and steps in herbarium preparation, Botanical gardens of the world and India Documentation: flora, virtual herbarium, keys: single access and multi-access, Taxonomic literature- Flora, Monograph, Revisions Manuals, Journals, Periodicals, References books	<b>08</b>
<b>III</b>	<b>Classification</b> Types of classification- Artificial-Linnaeus, Natural- Bentham and Hooker and Phylogenetic- Engler and Prantle	<b>04</b>
<b>IV</b>	<b>Botanical Nomenclature</b> Principles and rules (ICN), Binomial nomenclature Ranks and endings of taxa names, Typification, Author citation Valid Publication, Rejection of names, Principle of priority and its limitations	<b>05</b>
<b>V</b>	<b>Study of Plant Families</b> Study of following families with reference to geographical distribution, diagnostic characters, floral formula, floral diagram, systematic position and Economic Importance Polypetalae- Annonaceae, Leguminosae, Myrtaceae, Gamopetalae- Rubiaceae, Apocynaceae, Lamiaceae, Apetalae, Euphorbiaceae and Monocot- Amaryllidaceae	<b>10</b>
<b>VI</b>	<b>Introduction to plant ecology.</b> Basic concepts, Interrelationships between the living world and the environment, Role of Ecology in conservation- In-situ, ex-situ; gene banks, institutions - National & International; sacred groves, on-farm conservation.	<b>04</b>



<b>VII</b>	<b>Soil and Water</b> Origin & Formation; physical, chemical and organic components; soil profile; forms of water in soil Importance; States of water in the environment; Atmospheric moisture; Water table	<b>6</b>
<b>VIII</b>	<b>Ecosystem Ecology:</b> Introduction, ecological organization – species population, Community ecosystem and biosphere, Kinds of ecosystem, structure and function of ecosystem, abiotic components, biotic components and their role, ecosystem dynamics, Ecosystem energetics – energy flow, processes within ecosystem, nutrient cycling, food chain, food web, ecological pyramids – pyramids of number, biomass, energy and homeostasis. Bio-geo-chemical cycles-concept, enlisting, details of Carbon, nitrogen and phosphorus cycle, Composition and functioning of ecosystem: Simple – pond ecosystem, Complex – forest ecosystem, Artificial – cropland ecosystem	<b>9</b>
<b>IX</b>	<b>Ecological grouping of plants:</b> Ecological grouping of plants with reference to their significance of adaptive external and internal features: Hydrophytes, Mesophytes, Xerophytes	<b>06</b>
<b>X</b>	<b>Community dynamics (Ecological Succession):</b> Introduction, causes - physiographic, climatic and biotic Succession – a) Principles b) Types – primary and secondary c) Succession on land (xerosere), rock (Lithosere) and in water(Hydrosere) Stages – Nudation, Migration. Competition, Ecesis and Climax	<b>05</b>

## Learning Resources:

Reference Books	<ol style="list-style-type: none"><li>1. Chapman, J.L. and Reiss, M.J. (1998). Ecology: Principles and applications. Cambridge, University Press.</li><li>2. Chopra G.L. (1984). Angiosperms: Systematics and Life-Cycle., Pradeep Publications</li><li>3. Cooke, Theodore (1903-8). The Flora of the Presidency of the Bombay Vol. I, II, III (Repr. ed), Botanical Survey of India.</li><li>4. Cronquist, A. (1968). The Evolution and Classification of Flowering Plants. Thomas Nel and Sons Ltd. London.</li><li>5. Datta S.C. (1988). Systematic Botany. New Age Publ.</li><li>6. Davis P.H and V.H Heywood (1963). Principles of Angiosperm Taxonomy. Oliver and Boyd, London.</li><li>7. Heywood V.H. (1967). Plant Taxonomy, Hodder &amp; Stoughton Educational, London.</li><li>8. Kormondy Edward (1995). Concepts of Ecology, Pearson Publ.</li><li>9. Lawrence G.H.M. (1955). An Introduction to Plant Taxonomy. McMillan, New York.</li><li>10. Naik V.N. (1988) Taxonomy of Angiosperms. Oxford and IBH</li><li>11. Odum E.P., (2004). Fundamentals of Ecology, Publ. Cengage Learning, Australia</li><li>12. Pande B.P. (1997). Taxonomy of Angiosperms. S. Chand.</li><li>13. Pande B.P. (2001) Taxonomy of Angiosperms. S. Chand.</li><li>14. Sharma O.P. (2011), Plant Taxonomy, Tata Mc grow Hill</li><li>15. Taxonomy. Cambridge Univ. Press</li><li>16. Shukla Priti and Shital Mishra (1982). An introduction to Taxonomy of angiosperms. Vikas Publ.</li><li>17. Simpson, M.G. (2010). Plant Systematics. Elsevier, Amsterdam.</li><li>18. Singh Gurucharan (2005). Systematics: Theory and Practice. Oxford IBH.</li><li>19. Singh J.S., S.P. Singh, and S.R. Gupta (2006). Ecology, Environment and Resource Conservation. Anamaya Publ. New Delhi.</li><li>20. Singh V. and D.K. Jain, (1981). Taxonomy of Angiosperms. Rastogi Publication, Meerut.</li><li>21. Santra, S. C. (2015) Environmental Science. New Central Book Agency (P) Ltd. Kolkata.</li><li>22. M. C. Das and S. P. Das (2009). Fundamental of Ecology. Tata MGrow Hill, New Delhi.</li><li>23. Shukla and Chandel (2016). A text book of Plant Ecology. S Chand Publication, New Delhi.</li></ol>
E- Resources	<p><a href="https://www.delta-intkey.com/angio/index.htm">https://www.delta-intkey.com/angio/index.htm</a> <a href="http://www.mobot.org/MOBOT/research/APweb/">http://www.mobot.org/MOBOT/research/APweb/</a></p>

	<a href="http://www.plantsoftheworldonline.org/">http://www.plantsoftheworldonline.org/</a> <a href="https://www.ipni.org/">https://www.ipni.org/</a> <a href="https://www.tropicos.org/home">https://www.tropicos.org/home</a> <a href="https://www.biodiversitylibrary.org/">https://www.biodiversitylibrary.org/</a> <a href="https://sites.google.com/site/efloraofindia/">https://sites.google.com/site/efloraofindia/</a> <a href="http://www.efloras.or">http://www.efloras.or</a>
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<b>S. Y. B. Sc. Semester IV</b>		
<b>BOT- 261</b>	<b>Fundamentals of Plant taxonomy and Ecology (Minor Theory)</b>	<b>Credits: 2 Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Describe and define basic terminologies of plant Taxonomy and Ecology	1
CO2	Differentiate and categorized morphology and economic importance of families	2
CO3	Implement the knowledge of plant nomenclature and Ecosystem Ecology	3
CO4	Identify and classify different families and ecological adaptations	4

<b>Unit No.</b>	<b>Title of Unit and Contents</b>	<b>No. of hours</b>
<b>I</b>	<b>Introduction to Plant Taxonomy</b> Concept of Taxonomy and Systematics, Definition, scope and objectives of taxonomy.	<b>02</b>
<b>II</b>	<b>Identification</b> Functions of Herbarium, List of important herbaria and steps in herbarium preparation, Botanical gardens of the world and India, Taxonomic literature- Flora, Monograph, Revisions Manuals, Journals, Periodicals, References books.	<b>06</b>
<b>III</b>	<b>Classification</b> Types of classification system: Artificial-Linnaeus, Natural-Bentham and Hooker, Phylogenetic- Engler and Prantle.	<b>03</b>
<b>IV</b>	<b>Study of Plant Families</b> Study of following families with reference to geographical distribution, diagnostic characters, floral formula, floral diagram, systematic position and economic importance: Polypetalae – Leguminosae, Gamopetalae – Apocynaceae, Apetalae - Euphorbiaceae , Monocotyledon – Amaryllidaceae.	<b>04</b>
<b>V</b>	<b>Introduction to plant ecology.</b> Basic concepts, Interrelationships between the living world and the environment, Role of Ecology in conservation- In-situ, ex-situ; gene banks, institutions - National & International; sacred groves, on-farm conservation.	<b>04</b>

<b>VI</b>	<b>Ecosystem Ecology:</b> Introduction, ecological organization – species population, community ecosystem and biosphere, Kinds of ecosystem, structure and function of ecosystem, abiotic components, biotic components and their role, ecosystem dynamics, Ecosystem energetics – energy flow, processes within ecosystem, nutrient cycling, food chain, food web, ecological pyramids – pyramids of number, biomass, energy and homeostasis.	<b>07</b>
<b>VII</b>	<b>Ecological grouping of plants</b> Ecological grouping of plants with reference to their significance of adaptive external and internal features: Hydrophytes and Xerophytes.	<b>04</b>

### Learning Resources:

Reference Books	<ol style="list-style-type: none"> <li>1. Cooke, Theodore (1903-8). The Flora of the Presidency of the Bombay Vol. I, II, III (Repr. ed), Botanical Survey of India.</li> <li>2. Datta S.C. (1988). Systematic Botany. New Age Publ.</li> <li>3. Mondol A.K. (2016) Advanced Plant Taxonomy, New Central Book Agency (NCBA).</li> <li>4. Naik V.N. (1988) Taxonomy of Angiosperms. Oxford and IBH.</li> <li>5. Sharma O.P. (2011), Plant Taxonomy, Tata Mc grow Hill.</li> <li>6. Simpson, M.G. (2010). Plant Systematics. Elsevier, Amsterdam.</li> <li>7. E.P. Odum. 1996 -Fundamentals of Ecology. Natraj Publishing, Dehradun.</li> <li>8. Kumar.H.D. 1997 -General Ecology. Vikas Publishing Pvt. Ltd., Delhi.</li> <li>9. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8 th edition.</li> <li>10. Shukla and Chandel (2016). A text book of Plant Ecology. S Chand Publication, New Delhi.</li> <li>11. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.</li> </ol>
E- Resources	<p><a href="http://www.plantsoftheworldonline.org/">http://www.plantsoftheworldonline.org/</a></p> <p><a href="https://www.biodiversitylibrary.org/">https://www.biodiversitylibrary.org/</a></p> <p><a href="https://sites.google.com/site/efloraofindia/">https://sites.google.com/site/efloraofindia/</a></p>

<b>S. Y. B. Sc. Semester IV</b>		
<b>BOT- 262</b>	<b>Botany Practical IV (Minor - Practical)</b>	<b>Credits: 2 Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		Bloom's cognitive level
CO1	List out morphological and anatomical adaptive characters in ecological grouping	1
CO2	Classifies and identifies plants up to family level	2
CO3	Interpret vegetation by List Count Quadrante method	3
CO4	Distinguish wild plants to their respective families	4

<b>Practical No.</b>	<b>Title of the Practical</b>
1.	Study of Tools of Taxonomy – field, library and laboratory
2.	Description of plant in botanical terms.
3.	Study of plant families Leguminosae and Apocynaceae with respect to vegetative and floral characters.
4.	Study of plant families Euphorbiaceae and Amaryllidaceae with respect to vegetative and floral characters.
5.	Botanical Excursion/ Visit to Botanical Garden.
6.	Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer and hygrometer.
7.	Determination of pH and water holding capacity of two soil samples.
8.	Study of morphological adaptations of hydrophytes with any two examples.
9.	Study of morphological adaptations of xerophytes with any two examples.
10.	Quantitative analysis of herbaceous vegetation in the college campus for frequency, density, abundance and comparison with Raunkiaer's frequency distribution law

<b>S. Y. B. Sc. Semester IV</b>		
<b>BOT -270</b>	<b>Fruit and Vegetable Processing (OE-VI)</b>	<b>Credits: 2 Hours: 30</b>
<b>Course Outcomes (COs) On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Highlight the importance of fruit and vegetable processing and will identify different technique of processing.	1
CO2	Associate the changes in quality of fruits and vegetables during processing and storage.	2
CO3	Apply knowledge on technology of preservation and value addition of fruits and vegetables.	3
CO4	Relate processing and technology for fruits and vegetables according to its products.	4

<b>Unit No.</b>	<b>Title of Unit and Contents</b>	<b>No. of hours</b>
<b>I</b>	<b>Introduction</b> Importance of fruits and vegetable, History and need of preservation, Reasons of spoilage, Method of preservations (short & long term).	<b>4</b>
<b>II</b>	<b>Fruit Beverages</b> Fruit juices: Constituents, selection of fruits, processing & technology. Fruit squash: Constituents, selection of fruits, processing & technology.	<b>4</b>
<b>III</b>	<b>Jams and Jellies</b> Jam: Constituents, selection of fruits, processing & technology. Jelly: Essential constituents (Role of pectin, ratio), selection of fruits, Processing & technology.	<b>4</b>
<b>IV</b>	<b>Pickles and Chutneys</b> Pickles: Types, Processing, Causes of spoilage in pickling. Chutneys: Types, Processing, Causes of spoilage in chutneys.	<b>4</b>
<b>V</b>	<b>Tomato Products</b> Selection of tomatoes, pulping & processing: Tomato juice, Tomato puree, Tomato ketchup, Tomato soup.	<b>4</b>
<b>VI</b>	<b>Dehydration of Foods and Vegetables</b> Sun drying & mechanical dehydration, Process, variation for fruits and vegetables, packing and storage: Raisins, Anardana, Dried fig, Dried leafy vegetables, Juice powders.	<b>6</b>
<b>VII</b>	Visit to food processing unit and report submission	<b>4</b>

## Learning Resources:

<b>Reference Books</b>	<ol style="list-style-type: none"><li>1. Girdharilal and Siddappa, Preservation of Fruits and Vegetables, Kalyani Publishers, 2001</li><li>2. Subalakshmi, G and Udipi, SA: Food processing and preservation, 1st Ed. New Age International (P) Ltd. 2006</li><li>3. Cruces, W.V. Commercial fruits and Vegetable products, Agrobios Publishers, 2009</li><li>4. Desrosier NW and Desrosier JN: The Technology Of Food Preservation, 4th Ed. CBS Publishers and Distributors, New Delhi. 2006</li><li>5. Khurdia DS. Preservation of fruits and vegetables. Indian Council of Agriculture Research, New Delhi 1995</li><li>6. Knechtges LI. Food Safety-Theory and Practice, USA: Jones and Barlette Learning 2012</li><li>7. Ramaswamy H and Marcott M. Food Processing Principles and Applications. CRC Press, 2005.</li><li>8. Srivastava, R.P. and Kumar, S. Fruits and Vegetables Preservation-Principles and Practices. 3rd Ed. International Book Distributing Co 2006.</li></ol>
<b>E-resources:</b>	<ol style="list-style-type: none"><li>1. <a href="https://www.foodtown.com/articles/select-fresh-fruits-vegetables">https://www.foodtown.com/articles/select-fresh-fruits-vegetables</a></li><li>2. <a href="http://wiki.zeroemissions.at/index.php/Peeling_in_food_industry">http://wiki.zeroemissions.at/index.php/Peeling_in_food_industry</a></li><li>3. <a href="http://www.agritech.tnau.ac.in/postharvest/fpo_spec.html">http://www.agritech.tnau.ac.in/postharvest/fpo_spec.html</a></li><li>4. <a href="https://www3.epa.gov/ttn/chief/ap42/ch09/final/c9s08-2.pdf">https://www3.epa.gov/ttn/chief/ap42/ch09/final/c9s08-2.pdf</a></li><li>5. <a href="http://www.madehow.com/Volume4/Raisins.html#ixzz6d7LmmHcC">http://www.madehow.com/Volume4/Raisins.html#ixzz6d7LmmHcC</a></li><li>6. <a href="https://medium.com/@luolaner521/several-methods-of-making-dried-figs-cea083e2d01">https://medium.com/@luolaner521/several-methods-of-making-dried-figs-cea083e2d01</a></li></ol>

<b>S. Y. B. Sc. Semester IV</b>		
<b>BOT- 280</b>	<b>Nursery and Gardening (VSC)</b>	<b>Credits: 2 Hours:30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Describe the types of gardens.	1
CO2	Differentiate the different types of horticultural plants	2
CO3	Practice the methods for propagation of plants	3
CO4	Explore various nursery operations.	4

<b>Unit No.</b>	<b>Title of Unit and Contents</b>	<b>No. of hours</b>
<b>I</b>	<b>Nursery Management</b> Definition, objectives and scope of nursery. Building up of infrastructure for nursery. Methods of preparation of nursery beds and sowing of seeds. Media for propagation of plants in nursery beds and pots.	<b>07</b>
<b>II</b>	<b>Propagation methods</b> Study and practice of different propagation methods viz., cutting, layering, grafting and budding. Bonsai making.	<b>06</b>
<b>III</b>	<b>Gardens</b> Study of different types of gardens - indoor and outdoor. Key features of gardens (Paths & Avenues, Lawn, Flowerbeds, Arches & Pergolas, Fencing, Water bodies, Rock Garden)	<b>07</b>
<b>IV</b>	<b>Study of horticultural plants.</b> Herbs, Shrubs and Avenue trees with respect to foliage and flowering, Climbers, Lianas, Epiphytes, Creepers, Trailers, Aquatic plants, Succulents, Weeds.	<b>08</b>
<b>V</b>	Visit to a nursery and report submission.	<b>04</b>

#### **Learning Resources:**

<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Bose T.K. &amp; Mukherjee, D. (1972). Gardening in India, Oxford &amp; IBH Publishing Co., New Delhi.</li> <li>2. Sandhu, M.K. (1989) Plant Propagation, Wile Eastern Ltd, Bengaluru.</li> <li>3. Kumar, N. (1997) Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.</li> <li>4. Edmond Musser &amp; Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.</li> <li>5. Gopaldaswamiengar, K. S., Parthasarathy, G., Mukundan, P. (1991). Complete Gardening in India. India: Gopaldaswamy Parthasarathy, 'Srinivasa'.</li> <li>6. Hartmann, H. T., Kester, D. E., Hartmann, H. T., Kester, D. E. (1975). Plant Propagation: Principles and Practices. India: Prentice-Hall.</li> <li>7. Hodge, G., Hodge, G. (2014). Practical Botany for Gardeners: Over 3,000 Botanical Terms Explained and Explored. United Kingdom: University of Chicago Press.</li> <li>8. Jules, J. (1979). Horticultural Science, 3rd edition. San Francisco,</li> </ol>
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	California: W.H. Freeman and Co. 9. Roy, R. K., Roy, R. K. (2013). Fundamentals of Garden Designing: A Colour Encyclopedia. India: New India Publishing Agency 10. The Royal Horticultural Society Gardening Manual. (2000). United Kingdom: Dorling Kindersley
E-Resource	<a href="https://infotracgalegroupcom.liblink.uncw.edu/itweb/wilm9959PGL">https://infotracgalegroupcom.liblink.uncw.edu/itweb/wilm9959PGL</a>

<b>S. Y. B. Sc. Semester IV</b>		
<b>BOT- 290</b>	<b>Plant Tissue Culture (SEC)</b>	<b>Credits: 02 Hours:30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's cognitive level</b>
CO1	Identify the infrastructure and equipment required to establish Plant Tissue Culture Laboratory.	1
CO2	Interpret various methods of sterilization.	2
CO3	Demonstrate media preparation method.	3
CO4	Relate to inoculation technique.	4

<b>Unit No.</b>	<b>Title of Unit and Contents</b>	<b>No. of hours</b>
<b>I</b>	<b>Basic concepts of plant tissue culture</b> Introduction to plant tissue culture, Terms and Definitions, Scope and significance.	<b>02</b>
<b>II</b>	<b>General Laboratory Techniques</b> Infrastructure and Equipment required to establish Plant Tissue Culture Laboratory. Equipments: Principle and working of pH meter, Hot Air Oven, Autoclave, Laminar Air Flow Hood, Rotary Shaker.	<b>06</b>
<b>III</b>	<b>Sterilization Techniques</b> Fumigation, Wet and Dry Heat Sterilization, Filter Sterilization, UV Sterilization and Chemical Sterilization.	<b>02</b>
<b>IV</b>	<b>Media Preparation</b> Composition of commonly used nutrient media, Role of macro and micro nutrients, vitamins, carbon source and solidifying agents, Method of preparation of stock solutions and growth regulators, Preparation of Murashige and Skoog's culture media.	<b>08</b>
<b>V</b>	<b>Inoculation</b> Selection and preparation of explants, Procedure for sterilization and inoculation of different explants.	<b>06</b>
<b>VI</b>	<b>Incubation and Hardening Techniques</b> Culture initiation and maintenance, subculture, temperature and humidity control, hardening and acclimatization.	<b>02</b>
<b>VII</b>	Visit to Plant Tissue Culture Laboratory and report submission	<b>04</b>

**Learning Resources:**

Reference Books	1. Bhojwani, S.S., Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Amsterdam, Netherlands: Elsevier Science. 2. Reinert, J. and Bajaj Y.P.S. (1989) Plant Cell, tissue and Organ Culture, Narosa Publishing House, New Delhi. 3. Chawla H.S., (2007). Introduction to Plant Biotechnology. CRC Press, New Delhi. 4. Gamborg O.L. and Phillips G., (2014). Plant Cell, Tissue and Organ Culture: Fundamental Methods, Springer Berlin Heidelberg.
E-resources	<a href="https://egyankosh.ac.in/handle/123456789/86107">https://egyankosh.ac.in/handle/123456789/86107</a> <a href="https://www.swayamprabha.gov.in">https://www.swayamprabha.gov.in</a>

**S. Y. B. Sc. Semester IV**

<b>BOT- 295</b>	<b>Community Engagement - Field Project (FP)</b>	<b>Credits: 02</b>
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**Foundations of Field Work (1 credit)**

<b>Topics Covered</b>	<b>Activities</b>
Field visits, Field work Reflection and Analysis	- Reflective journals on field experiences - Group presentations
Community Impact Assessment	- Methods for assessing project impact - Group project: Conduct impact assessment in a chosen community

**Advanced Field Work (1 credit)**

<b>Topics Covered</b>	<b>Activities</b>
Field Work, Project Presentation Review and Integration	- Review of key concepts from previous credits - Integration of community engagement and fieldwork principles - Analysis - Submission of CEP/FP project report

	<b>Credit</b>	<b>Student learning Hours</b>	<b>Course component</b>
Sem IV	2	60 hrs.	Exclusively Field Project

For field engagement/ Field Project: 1Credit=2 Hours.