# B. SC. (Hort.) Hons. Syllabus of Faculty of Horticulture

**Uttar Banga Krishi Viswavidyalaya**

## SEMESTERWISE COURSE DISTRIBUTION

### FIRST TERM

<table>
<thead>
<tr>
<th>Course no.</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSC-101</td>
<td>Introduction to Soil Science</td>
<td>2+1</td>
</tr>
<tr>
<td>GPB-101</td>
<td>Crop Physiology</td>
<td>2+1</td>
</tr>
<tr>
<td>PPT-101</td>
<td>Fundamentals of Horticulture</td>
<td>2+1</td>
</tr>
<tr>
<td>PPT-102</td>
<td>Plant propagation and Nursery management</td>
<td>1+1</td>
</tr>
<tr>
<td>EXT-101</td>
<td>Fundamentals of extension education</td>
<td>1+1</td>
</tr>
<tr>
<td>PCP-101</td>
<td>Growth and development of Horticulture crops</td>
<td>1+1</td>
</tr>
<tr>
<td>VSC-101</td>
<td>Tropical and subtropical Vegetables</td>
<td>2+1</td>
</tr>
<tr>
<td>AG-101</td>
<td>Communications skills in English</td>
<td>1+1</td>
</tr>
<tr>
<td>AG-102</td>
<td>Physical education</td>
<td>0+1</td>
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**Total: 12+9=21**

### SECOND TERM

<table>
<thead>
<tr>
<th>Course no.</th>
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<tbody>
<tr>
<td>AST-151</td>
<td>Fundamentals of Statistics</td>
<td>1+1</td>
</tr>
<tr>
<td>AST-152</td>
<td>Elements of computer application</td>
<td>1+1</td>
</tr>
<tr>
<td>ENT-151</td>
<td>Plant parasitic nematode and their management</td>
<td>1+1</td>
</tr>
<tr>
<td>PPT-151</td>
<td>Tropical and subtropical fruits</td>
<td>2+1</td>
</tr>
<tr>
<td>PPT-152</td>
<td>Fundamentals of food technology</td>
<td>1+1</td>
</tr>
<tr>
<td>GPB-151</td>
<td>Principles of genetics and cytogenetics</td>
<td>2+1</td>
</tr>
<tr>
<td>PPA-152</td>
<td>Fundamentals of plant pathology</td>
<td>2+1</td>
</tr>
<tr>
<td>SSC-151</td>
<td>Introductory Microbiology</td>
<td>1+1</td>
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<tr>
<td>ECO-151</td>
<td>Introductory Economics</td>
<td>2+0</td>
</tr>
<tr>
<td>VSC-151</td>
<td>Water management in Hort. Crops</td>
<td>1+1</td>
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**Total: 14+9=23**

### THIRD TERM

<table>
<thead>
<tr>
<th>Course no.</th>
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<th>Credit</th>
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<tbody>
<tr>
<td>PPT-201</td>
<td>Temperate fruits</td>
<td>1+1</td>
</tr>
<tr>
<td>FAM-201</td>
<td>Ornamental horticulture</td>
<td>2+1</td>
</tr>
<tr>
<td>AST-201</td>
<td>Fundamentals of statistics- II</td>
<td>1+1</td>
</tr>
<tr>
<td>BCH-201</td>
<td>Biochemistry</td>
<td>2+1</td>
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<tr>
<td>ENT-201</td>
<td>Fundamentals of Entomology</td>
<td>2+1</td>
</tr>
<tr>
<td>GPB-201</td>
<td>Principles of Plant breeding</td>
<td>2+1</td>
</tr>
<tr>
<td>VSC-201</td>
<td>Temperate Vegetables</td>
<td>1+1</td>
</tr>
<tr>
<td>Course no.</td>
<td>Title</td>
<td>Credit</td>
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<tr>
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</tr>
<tr>
<td>VSC-202</td>
<td>Potato and tuber Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>AEN-201</td>
<td>Farm power machinery and renewable energy</td>
<td>2+1</td>
</tr>
<tr>
<td>AG-201</td>
<td>National service scheme (NSS) (NC)</td>
<td>0+1</td>
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**FOURTH TERM**

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<tr>
<th>Course no.</th>
<th>Title</th>
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<tbody>
<tr>
<td>VSC-251</td>
<td>Spices and condiments</td>
<td>1+1</td>
</tr>
<tr>
<td>FAM-251</td>
<td>Commercial floriculture</td>
<td>2+1</td>
</tr>
<tr>
<td>PCP-251</td>
<td>Plantation crops</td>
<td>2+1</td>
</tr>
<tr>
<td>PPT-251</td>
<td>Orchard management</td>
<td>1+1</td>
</tr>
<tr>
<td>PPT-252</td>
<td>Breeding of fruits and Plantation crops</td>
<td>2+1</td>
</tr>
<tr>
<td>PPA-252</td>
<td>Mushroom culture</td>
<td>0+1</td>
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<tr>
<td>FOR-251</td>
<td>Environmental Science</td>
<td>2+1</td>
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<tr>
<td>ENT-251</td>
<td>Insect ecology and integrated pest management including beneficial insect</td>
<td>2+1</td>
</tr>
<tr>
<td>SSC-251</td>
<td>Soil science-I</td>
<td>2+1</td>
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<tr>
<td></td>
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**FIFTH TERM**

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<tbody>
<tr>
<td>AGR-302</td>
<td>Organic farming</td>
<td>1+1</td>
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<tr>
<td>AGR-303</td>
<td>Introduction of major field crops</td>
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<tr>
<td>FOR-301</td>
<td>Introductory Agroforestry</td>
<td>1+1</td>
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<tr>
<td>ENT-302</td>
<td>Apiculture</td>
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<tr>
<td>PPT-301</td>
<td>Post harvest management of horticultural crops</td>
<td>2+1</td>
</tr>
<tr>
<td>GPB-301</td>
<td>Principles of plant biotechnology</td>
<td>1+1</td>
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<tr>
<td>PPA-301</td>
<td>Disease of hort. Crops and their management-I</td>
<td>2+1</td>
</tr>
<tr>
<td>FAM-301</td>
<td>Breeding and seed production of ornamental plants</td>
<td>2+1</td>
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<tr>
<td>VSC-301</td>
<td>Breeding of vegetable, tuber and spice crops</td>
<td>2+1</td>
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<td>12+9=21</td>
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**SIXTH TERM**

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<tr>
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<tbody>
<tr>
<td>SSC-352</td>
<td>Remote sensing, GPS and GIS</td>
<td>1+1</td>
</tr>
<tr>
<td>EXT-351</td>
<td>Entrepreneurship Development</td>
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</tr>
<tr>
<td>VSC-351</td>
<td>Seed production of veg., tuber and spice crops</td>
<td>1+1</td>
</tr>
<tr>
<td>FAM-351</td>
<td>Medicinal and Aromatic plants</td>
<td>2+1</td>
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<tr>
<td>Course no.</td>
<td>Title</td>
<td>Credit</td>
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<tr>
<td>PCP-351</td>
<td>Processing of horticulture crops</td>
<td>1+2</td>
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<tr>
<td>ECO-352</td>
<td>Horti. Business management</td>
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<tr>
<td>ENT-351</td>
<td>Insect pest hort. Crops and their management</td>
<td>2+1</td>
</tr>
<tr>
<td>PPA-351</td>
<td>Disease of hort. Crops and their management</td>
<td>2+1</td>
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<tr>
<td>FAM-352</td>
<td>Principle of landscape gardening</td>
<td>0+1</td>
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<tr>
<td>AGR-352</td>
<td>Weed management</td>
<td>1+1</td>
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<td>13+10=23</td>
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**SEVENTH TERM**

<table>
<thead>
<tr>
<th>Course no.</th>
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<th>Credit</th>
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<tbody>
<tr>
<td>EL-401</td>
<td>Experimental Learning</td>
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**EIGHT TERM**

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<tr>
<th>Course no.</th>
<th>Title</th>
<th>Credit</th>
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<tbody>
<tr>
<td>RHWE</td>
<td>Rural horticultural work experience</td>
<td>0+10</td>
</tr>
<tr>
<td>IT</td>
<td>Industrial Training</td>
<td>0+10</td>
</tr>
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</table>
### DEPARTMENTWISE COURSE DISTRIBUTION

#### Department of Pomology and Post Harvest Technology

<table>
<thead>
<tr>
<th>Sl</th>
<th>Course</th>
<th>Name of the course</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PPT 101</td>
<td>Fundamentals of Horticulture</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>2.</td>
<td>PPT 102</td>
<td>Plant Propagation &amp; Nursery Management</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>PPT 151</td>
<td>Tropical and Sub-tropical Fruits</td>
<td>2+1</td>
</tr>
<tr>
<td>4.</td>
<td>PPT 152</td>
<td>Fundamentals of Food Technology</td>
<td>1+1</td>
</tr>
<tr>
<td>5.</td>
<td>PPT 201</td>
<td>Temperate Fruits</td>
<td>1+1</td>
</tr>
<tr>
<td>6.</td>
<td>PPT 251</td>
<td>Orchard Management</td>
<td>1+1</td>
</tr>
<tr>
<td>7.</td>
<td>PPT 252</td>
<td>Breeding of Fruits &amp; Plantation Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>8.</td>
<td>PPT 301</td>
<td>Post Harvest Management of Horticultural Crops</td>
<td>2+1</td>
</tr>
</tbody>
</table>

1. **PPT 101**  
   **Fundamentals of Horticulture**  
   **3(2+1)**

**Theory:** Economic importance and classification of horticultural crops and their culture and nutritive value, area and production, exports and imports, fruit and vegetable zones of India and of different states, nursery management practices, soil and climate, vegetable gardens, nutrition and kitchen garden and other types of gardens – principles, planning and layout, management of orchards, planting systems and planting densities. Production and practices for fruit, vegetable and floriculture crops, nursery techniques and their management. Principles and methods of pruning and training of fruit crops, types and use of growth regulators in horticulture, water management, weed management, fertility management in horticultural crops, cropping systems, intercropping, multi-tier cropping, mulching, bearing habits, factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, principles of organic farming.

**Practical:** Features of orchard, planning and layout of orchard, tools and implements, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits and vegetables, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.
2. PPT 102  Plant Propagation and Nursery Management  2(1+1)


**Practical:** Media for propagation of plants in nursery beds, pot and mist chamber. Preparation of nursery beds and sowing of seeds. Raising of rootstock. Seed treatments for breaking dormancy and inducing vigorous seedling growth. Preparation of plant material for potting. Hardening plants in the nursery. Practicing different types of cuttings, layering, graftings and buddings including opacity and grafting, etc. Use of mist chamber in propagation and hardening of plants. Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Digging, labeling and packing of fruit plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, polyhouse and their maintenance. Top grafting, bridge grafting and nursery management. Nutrient and plant protection applications during nursery.

3. PPT 151  Tropical and Sub-Tropical Fruits  3(2+1)

**Theory:** Horticultural classification of fruits including genome classification. Horticultural zones of India, detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, banana, bael, banana, grapes, citrus, papaya, sapota, guava, pineapple, jackfruit, avocado, mangosteen, litchi, carambola, durian and passion fruit. Bearing in mango and citrus, causes and control measures of special production problems, alternate and irregular bearing overcome, control measures. Seediness and kokkan disease in banana, citrus decline and
casual factors and their management. Bud forecasting in grapes, sex expression and seed production in papaya, latex extraction and crude papain production, economic of production. Rainfed horticulture, importance and scope of arid and semi-arid zones of India. Characters and special adaptation of crops: ber, aonla, annon, jamun, wood apple, bael, pomegranate, carissa, date palm, phalsa, fig, west Indian cherry and tamarind.

**Practical:** Description and identification of varieties based on flower and fruit morphology in above crops. Training and pruning of grapes, mango, guava and citrus. Selection of site and planting system, pre-treatment of banana suckers, desuckering in banana, sex forms in papaya. Use of plastics in fruit production. Visit to commercial orchards and diagnosis of maladies. Manure and fertilizer application including bio-fertilizer in fruit crops, preparation and application of growth regulators in banana, grapes and mango. Seed production in papaya, latex extraction and preparation of crude papain. Ripening of fruits, grading and packaging, production economics for tropical and sub-tropical fruits. Mapping of arid and semi-arid zones of India. Botanical description and identification of ber, fig, jamun, pomegranate, carissa, phalsa, wood apple, West Indian cherry, tamarind, aonla, bael and annon.

4. PPT 152                      Fundamentals of Food Technology       2 (1+1)


**Practical:** Methods of measuring food ingredients, effect of cooking on volume and weight, determination of percentage of edible portion. Browning reactions of fruits and vegetables. Microscopic examination of starches, estimation of energy, value proteins and fats of foods. Planning diet for various age groups.
5. PPT 201  
Temperate Fruits  
2(1+1)

Theory: Classification of temperate fruits, detailed study of areas, production, varieties, climate and soil requirements, propagation, planting density, cropping systems, after care training and pruning, self incompatibility and pollinisers, use of growth regulators, nutrient and weed management, harvesting, post-harvest handling and storage of apple, pear, peach, apricot, cherry, persimmon, strawberry, kiwi, Queensland nut (Mecademia nut), almond, walnut, pecan nut, hazel nut and chestnut. Re-plant problem, rejuvenation and special production problems like pre-mature leaf fall, physiological disorders, important insects – pests and diseases and their control measures.

Practical: Nursery management practices, description and identification of varieties of above crops, manuring and fertilisation, planting systems, preparation and use of growth regulators, training and pruning in apple, pear, plum, peach and nut crops. Visit to private orchards to diagnose maladies. Working out economics for apple, pear, plum and peach.

6. PPT 251  
Orchard Management  
2(1+1)

Theory: Orchard management, importance, objectives, merits and demerits, clean cultivation, sod culture, sod mulch, herbicides and inorganic and organic mulches. Tropical, sub-tropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems. Biological efficiency of cropping systems in horticulture, systems of irrigation. Soil management in relation to nutrient and water uptake and their effect on soil environment, moisture, organisms and soil properties. Integrated nutrient and pest management. Utilization of resources constraints in existing systems. Crop model and crop regulation in relation to cropping systems.

Practical: Layout of different systems of orchard soil management, clean, inter, cover and mixed cropping, fillers. Use of mulch materials, organic and inorganic, moisture conservation, weed control. Layout of various irrigation systems.

7. PPT 252  
Breeding of Fruit and Plantation Crops  
3 (2+1)

Theory: Fruit breeding - History, importance in fruit production, distribution, domestication and adaptation of commercially important fruits, variability for economic traits, breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement – policy manipulations – in vitro breeding tools (important fruit and plantation crops).
Practical: Exercises on floral biology, pollen viability; emasculation and pollination procedures; hybrid seed germination; raising and evaluation of segregating populations; use of mutagens to induce mutations and polyploidy.

8. PPT 301 Post Harvest Management of Horticultural Crops 3 (2+1)


Practical: Practice in judging the maturity of various horticultural produce, determination of physiological loss in weight and quality. Grading of horticultural produce, post-harvest treatment of horticultural crops, physical and chemical methods. Packaging studies in fruits, vegetables, plantation crops and cut flowers by using different packaging materials, methods of storage, post-harvest disorders in horticultural produce. Identification of storage pests and diseased in spices. Visit to markets, packaging houses and cold storage units.

Department of Vegetable and Spice Crops

VSC-101: Tropical and Sub-Tropical Vegetables 3(2+1)
VSC-151: Water Management in Horticultural Crops 2(1+1)
VSC-251: Spices and Condiments 2(1+1)
VSC-201: Temperate Vegetables 2(1+1)
VSC-202: Potato and Tuber Crops 2(1+1)
VSC-301: Breeding of Vegetable, Tuber and Spice Crops 3(2+1)
VSC-351: Seed Production of Vegetable, Tuber and Spice Crops 3(2+1)

VSC-101: Tropical and Sub-Tropical Vegetables 3(2+1)
Area, production, economic importance and export potential of tropical and subtropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield and seed production. Economic of cultivation of tropical and sub-tropical vegetable crops; post-harvest handling and
storage. Marketing of tomato, brinjal, chillies, okra, amaranthus, cluster beans, cowpea, lablab, snap bean, cucurbits, moringa, curry leaf, portulaca and basella.

Practical: Identification and description of tropical and sub-tropical vegetable crops; nursery practices and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable culture; top dressing of fertilizers and intercultural; use of growth regulators; identification of nutrient deficiencies. Physiological disorder. Harvest indices and maturity standards, post-harvest handling and storage, marketing, seed extraction (cost of cultivation for tropical and sub-tropical vegetable crops), project preparation for commercial cultivation.

VSC-151: Water Management in Horticultural Crops 2(1+1)

Practical: Measurements of irrigation water by using water measuring devices, use of common formula in irrigation practices, practicing of land leveling and land shaping implements, layout for different methods of irrigation. Estimation of soil moisture constants, and soil moisture by using different methods and instruments, scheduling of irrigation, different approaches, practicing use of instruments, estimation of irrigation efficiency and water requirements of horticultural crops, irrigation planning and scheduling, soil moisture conservation practices.

VSC-201: Temperate Vegetables 2(1+1)
Importance of cool season vegetable crops in nutrition and national economy. Area, production, export potential, description of varieties and hybrids, origin, climate and soil, production technologies, seed production, post-harvest technology. Marketing of cabbage, cauliflower, knol-khol, sprouting broccoli, Brussels’ sprout, lettuce, palak, Chinese cabbage, spinach, garlic, onion, leek, radish, carrot, turnip, beet root, peas, broad beans, rhubarb, asparagus, globe artichoke.

Practical: Identification and description of varieties/hybrids; propagation methods, nursery management; preparation of field, sowing/transplanting; identification of physiological and nutritional disorders and their corrections; post-harvest handling; cost of cultivation and field visits to commercial farms.
**VSC- 202: Potato and Tuber Crops 2(1+1)**

Origin, area, production, economic importance and export potential of potato and tropical, sub-tropical and temperate tuber crops; description of varieties and hybrids. Climate and soil requirement, season; seed rate; preparation of field; planting practices; spacing; water, nutrient and weed management; nutrient deficiencies. Use of chemicals and growth regulators; cropping systems. Harvesting practices, yield; seed production, economic of cultivation. Post-harvest handling and storage, field and seed standards, marketing. Crops to be covered – potato, tapioca, sweet potato, arrow root, cassava, colocasia, xanthosoma, amorphophallus, dioscorea, Jerusalem artichoke, horse radish and other under exploited tubercrops.

**Practical:** Identification and description of potato and tropical, sub-tropical and temperate tuber crops; planting systems and practices; field preparation and sowing/planting. Topdressing of fertilizers and interculture and use of herbicides and growth regulators; identification of nutrient deficiencies, physiological disorders; harvest indices and maturity standards, post-harvest handling and storage, marketing. Seed collection, working out cost of cultivation, project preparation of commercial cultivation.

**VSC- 251: Spices and Condiments 2(1+1)**

History, scope and importance, area and production, uses, export potential and role in national economy. Classification, soil and climate, propagation-seed, vegetative and micropropagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products, methods of extraction of essential oil and oleoresins. Economics of cultivation, role of Spice Board and Pepper Export Promotion Council, institutions and research centers in R&D. Crops: Cardamom, pepper, ginger, turmeric, clove, nutmeg, cinnamon, all spice, curry leaf, coriander, fenugreek, fennel, cumin, dill, celery, bishops weed, saffron, vanilla, thyme and rosemary.

**Practical:** Identification of varieties: propagation, seed treatment – sowing; layout, planting; hoeing and earthing up; manuring and use of weedicides, training and pruning; fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

**VSC- 301: Breeding of Vegetable, Tuber and Spice Crops 3(2+1)**


VSC- 351: Seed Production of Vegetable, Tuber and Spice Crops 3(2+1)


Department of Floriculture, Medicinal and Aromatic Plants

FAM- 201: Ornamental Horticulture 3 (2+1)
FAM- 251: Commercial Floriculture 3(2+1)
FAM- 301: Breeding and Seed Production of Ornamental Crops 3(2+1)
FAM- 351: Medicinal and Aromatic Crops 3 (2+1)
FAM- 352: Principles of Landscape Gardening 1 (0+1)

FAM- 201: Ornamental Horticulture 3 (2+1)
History, scope of gardening, aesthetic values. Gardens in India, types of gardens. Landscaping, historical background, definition. Floriculture industry: importance, area and production, industrial importance in India. Landscaping, basic principles and basic components. Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses and cacti succulents. Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for

**Practical:** Identification and description of annuals, herbaceous, perennials, climbers, creepers, foliage flowering shrubs, trees, palms, ferns, ornamental grasses; cacti and succulents. Planning and designing gardens, layout of location of components of garden study, functional uses of plants in the landscape. Planning design of house garden, roadside planting, avenues for new colonies, traffic islands, preparation of land for lawn and planting. Description and design of garden structures, layout of rockery, water garden, terrace garden, and Japanese gardens, recreational and children’s corner. Layout of terrarium, traffic islands, bottle garden, dish garden. Flower arrangement, bonsai practicing and training. Visit to nearby gardens. Identification and description of species/varieties of jasmine, chrysanthemum, marigold, dahlia, gladiolus, carnation, aster and their important inter-culture practices.

**FAM- 251: Commercial Floriculture 3(2+1)**
Scope and importance of commercial floriculture in India, production techniques of ornamental plants like rose, marigold, chrysanthemum, orchid, carnation, gladiolus, jasmine, dahlia, tuberose, bird of paradise, china aster and gerbera for domestic and export market, growing of flowers under protected environments such as glass house, plastic house etc., postharvest technology of cut flowers in respect of commercial flower crops, dehydration technique for drying of flowers, production techniques for bulbous.

**Practical:** Identification of commercially important floricultural crops. Propagation practices in chrysanthemum, sowing of seeds and raising of seedlings of annuals. Propagation by cutting, layering, budding and grafting. Training and pruning of roses. Use of chemicals and other compounds for prolonging the vase life of cut flowers. Drying and preservation of flowers. Flower arrangement practices.

**FAM- 301: Breeding and Seed Production of Ornamental Crops 3(2+1)**

**Practical:** Study of floral biology and pollination in important species and cultivars. Techniques of inducing polyploidy and mutation. Production of pure and hybrid seeds. Harvesting, conditioning and testing of seeds. Practice in seed production methods.

**FAM- 351: Medicinal and Aromatic Crops 3 (2+1)**
History, scope, opportunities and constraints in the cultivation and maintenance of medicinal and aromatic plants in India. Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and after care,
cultural practices, training and pruning, nutritional and water requirements. Plant protection, harvesting and processing of undermentioned important medicinal and aromatic plants. Study of chemical composition of a few important medicinal and aromatic plants, extraction, use and economics of drugs and essential oils in medicinal and aromatic plants. Therapeutic and pharmaceutical uses of important species. Medicinal Plants: Betelvine, periwinkle, Rauvolfia, Dioscorea, Isabgol, Ammimajus, Belladonna, Cinchona, Pyrethrum and other species relevant to local conditions. Aromatic Plants: Citronella grass, khus grass, flag (baje), lavender, geranium, patchouli, bursera, enthe, musk, Ocimum and other species relevant to the local conditions.

**Practical**: Collection of medicinal and aromatic plants from their natural habitat and study their morphological description, nursery techniques, harvesting, curing and processing techniques and extraction essential oils.

**FAM-352: Principles of Landscape Gardening 1 (0+1)**

**Practical**: Principles and elements of landscape design, plant material for landscaping, symbols, tools and implements used in landscape design, layout of formal gardens, informal gardens, special type of gardens (bog garden, sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house. Landscape design for specific areas.

**Department of Plantation Crops and Processing**

**PCP-101: Growth and Development of Horticultural Crops 2 (1+1)**
**PCP-251: Plantation Crops 3 (2+1)**
**PCP-351: Processing of Horticultural Crops 3 (1+2)**

**PCP-101: Growth and Development of Horticultural Crops 2 (1+1)**

Growth and development—definitions, components, photosynthetic productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, growth analysis in horticultural crops. Plant bioregulators—auxin, gibberellin, cytokinin, ethylene inhibitors and retardants, basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening. Flowering—factors affecting flowering, physiology of flowering, photoperiodism—long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training physiological basis of training and pruning source and sink relationship, translocation of assimilates. Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops. Physiology of fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits—climatic and nonclimacteric fruits.

**Practical**: Estimation of photosynthetic potential of horticultural crops, leaf area index, growth analysis parameters including harvest index, bioassay of plant hormones, identification of synthetic plant hormones and growth retardants, preparations of hormonal solutions and induction of rooting in cuttings, ripening of fruits and control of
flower and fruitdrop. Important physiological disorders and their remedial measures in fruits and vegetables, rapid tissue test, seed dormancy, seed viability by tetrazolium test, seed germination and breaking seed dormancy with chemicals and growth regulators.

**PCP-251: Plantation Crops 3(2+1)**

History and development, scope and importance, area and production, export and import potential, role in national and state economy, uses, industrial importance, by products utilization, soil and climate, varieties, propagation: principles and practices of seed, vegetative and micro-propagation, planting systems and method, gap filling, systems of cultivation, mulching, shade regulation, weed and water management, training, pruning and handling, nutrition, foliar feeding, role of growth regulators, soil management, liming practices, tipping practices, top working, physiological disorders, harvesting, post-harvest handling and processing, packaging and marketing, yield and economics of coconut, arecanut, oil palm, palmyrah palm, cacao, cashew nut, coffee, tea and rubber.

**Practical:** Description and identification of coconut varieties, selection of coconut and arecanut mother palm and seed nut, planting of seed nuts in nursery, layout and planting of coconut, arecanut, oil palm, cashew nut, cacao gardens, manuring, irrigation, mulching, raising masonry nursery for palm, nursery management in cacao. Description and identification of species and varieties in cacao, harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry collection, seed extraction, treatment and sowing of coffee, epicotyl, softwood, grafting and top working in cashew, working out the economics and project preparation for coconut, arecanut, oil palm, cashew nut, cacao, etc. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, centering, pruning, tipping and harvesting of tea.

**PCP-351: Processing of Horticultural Crops 3 (1+2)**

Importance and scope of fruit and vegetable preservation industry in India, food pipeline, losses in post-harvest operations, unit operations in food processing, Principles and guidelines for the location of processing units. Principles and methods of preservation by heat pasteurization, canning, bottling. Methods of preparation of juices, squashes, syrups, cordials and fermented beverages. Jam, jelly and marmalade. Preservation by sugar and chemicals, candies, crystallized fruits, preserves chemical preservatives, preservation with salt and vinegar, pickling, chutneys and sauces, tomato and mushrooms, freezing preservation. Processing of plantation crops, products, spoilage in processed foods, quality control of processed products, Govt. policy on import and export of processed fruits. Food laws.

**Practical:** Equipment used in food processing units. Physico-chemical analysis of fruits and vegetables. Canning of fruits and vegetables, preparation of squash, RTS, cordial, syrup, jam, jelly, marmalade, candies, preserves, chutneys, sauces, pickles (hot and sweet). Dehydration of fruits and vegetables – tomato product dehydration, refrigeration and freezing, cut out analysis of processed foods. Processing of plantation crops. Visit top processing units.
FOR- 251: Environmental Science 3 (2+1)
FOR-301: Introductory Agroforestry 2 (1+1)

FOR- 251: Environmental Science 3 (2+1)

Practical: Visit to local areas - river/forest/ grassland/catchment etc. to document components of ecosystem. Study of common plants, insects, birds and animals. Visit to industries to study pollution abatement techniques.

FOR-301: Introductory Agroforestry 2 (1+1)
Agroforestry – definition, objectives and potential. Distinction between agroforestry and social forestry. Status of Indian forests and role in India farming systems. Agroforestry system, sub-system and practice: agri-silviculture, silvipastoral, horti-silviculture, hortisilvipastoral, shifting cultivation, taungya, home gardens, alley cropping, intercropping, windbreaks, shelterbelts and energy plantations. Planning for agroforestry - constraints, diagnosis and design methodology, selection of tree crop species for agroforestry. Agroforestry projects – national, overseas, MPTS – their management practices, economics of cultivation – nursery and planting (Acacia catechu, Dalbergiasissoo,, Tectona, Populus, Morus, Grewia, Eucalyptus, Quercus spp. and bamboo, tamarind, neem etc.)

Practical: Identification and seeds and seedlings of multipurpose tree species. Nursery practices for poplar, Grewia optiva, Morusalba, Acacia catechu, Dalbergiasissoo, robinia, leucaena etc. Visit to agro-forestry fields to study the compatibility of MPTS with agricultural crops: silvipastoral, alley cropping, horti-silviculture, agro-silvipasture, fuel and fodder blocks. Visit to social forestry plantations – railway line plantations, canal plantations, roadside plantations, industrial plantations and shelterbelts. Rapid assessment of farmers needs for green manure, fodder, fuel wood in selected villages. Economics and marketing of products raised in agro-forestry systems.
AGR-301: Weed Management in Horticultural Crops 2 (1+1)
AGR-302: Organic Farming 2(1+1)

AGR-301: Weed Management in Horticultural Crops 2 (1+1)
Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy. Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management; Herbicides: advantages and limitations of herbicide usage in India, Herbicide classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides; Introduction to selectivity of herbicides; Compatibility of herbicides with other agrochemicals; Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic and problematic weeds and their control.

Practical: Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, parthenium and celosia; Economics of weed control practices; Tours and visits of problem areas.

AGR-302: Organic Farming 2(1+1)
Introduction, concept, relevance in present context; Organic production requirements; Biological intensive nutrient management—organic manures, vermicomposting, green manuring, recycling of organic residues, biofertilizers; Soil improvement and amendments; Integrated diseases and pest management—use of biocontrol agents, biopesticides, pheromones, trap crops, bird perches; Weed management; Quality considerations, certification, labeling and accreditation processors, marketing, exports.

Practical: Raising of vegetable crops organically through nutrient, diseases and pest management; vermicomposting; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, post harvest management.
GPB- 101: Crop Physiology 3(2+1)

GPB-151: Principles of Genetics and Cytogenetics 3(2+1)

GPB- 201: Principles of Plant Breeding 3 (2+1)

GPB- 101: Crop Physiology 3(2+1)


Practicals
GPB-151: Principles of Genetics and Cytogenetics 3 (2+1)
Mendel’s laws of inheritance and exceptions to the laws; Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits, Qualitative traits and difference between them; Multiple factor hypothesis; Cytoplasmic inheritance, its characteristics features and difference between chromosomal and cytoplasmic inheritance; Mutation and its characteristics features; Method of inducing mutation and C/B technique. Gene expression and differential gene activation; Lac operon and fine structure of gene; Ultra structure of cell and cell organelles and their functions; Study of chromosome structure, morphology, number and types, Karyotype and Idiogram; Mitosis and meiosis, their significance and difference between them; DNA and its structure, function, types, mode of replication and repair. RNA and its structure, function and types; Transcription, Translation, Genetic code and outline of protein synthesis; Crossing over and factor affecting it; Mechanism of crossing over and cytological proof of crossing over; Linkage, Types of linkage and estimation of linkage; Numerical chromosomal aberrations (Polyploidy) and evolution of different crop species like Cotton, Wheat, Tobacco and Brassicas; Structural chromosomal aberrations.

**Practical:** Microscopy (Light microscope and electron microscopes; Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identifications of various stages of mitosis; Preparation of micro slides and identifications of various stages of meiosis; Monohybrid ratio and its modifications; Dihybrid ratio and its modification; Trihybrid ratio; Chi-square analysis and Interaction of factors; Epistatic factors; Supplementary factors and duplicate factors; Complementary factors; Additive factors and Inhibitory factors; Linkage – Two point test cross; Linkage – Three point test cross; Induction of polyploidy using colchicines; Induction of chromosomal aberrations using chemicals.

GPB- 201: Principles of Plant Breeding 3 (2+1)
Floral biology, Emasculation and pollination techniques in cereals, millets, pulses, oil seeds, fibers, plantation crops etc. Aims and objectives of Plant Breeding; Modes of reproduction, sexual, asexual, apomixsis and their classification; Significance in plant breeding; Modes of Pollination, genetic consequences, difference between self and cross pollinated crops; Methods of breeding – introduction and acclimatization. Selection, Mass selection Johannson’s pure line theory, genetic basis, pure line selection; Hybridization, Aims and objectives, types of hybridization; Methods of handling of segregating generations, Pedigree method, Bulk method, Back cross method and various modified methods; Incompatibility and male sterility and their utilization in crop improvement; Heterosis, Inbreeding depressions, Various theories of heterosis, exploitation of hybrid vigour development of inbred lines, single cross and double cross hybrids; Population improvement programmes, recurrent selection, synthetics and composites; Methods of breeding for Vegetatively propagated crops; Clonal selection; Mutation breeding; Ploidy breeding; Wide hybridization, significance in crop improvement.

**Practical:** Botanical description and floral biology; Plant breeders kit; Hybridization techniques and precautions to be taken; Floral morphology, selfing, emasculation and crossing techniques; Study of male sterility and incompatibility in field plots; Rice, Maize and Wheat; and Sesamum; Redgram, and Greengram; Chillies, Brinjal and Tomato; Onion, Bottle gourd and Ridge gourd.
PPA- 152: Fundamentals of Plant Pathology 3 (2+1)
PPA – 252: Mushroom Culture 1(0+1)
PPA – 301: Diseases Horticultural Crops and their management- I 3 (2+1)
PPA – 351: Diseases Horticultural Crops and their management- II 3 (2+1)

PPA- 152:Fundamentals of Plant Pathology 3 (2+1)


PPA – 252:Mushroom Culture 1(0+1)

PPA – 301: Diseases Horticultural Crops and their management- I 3 (2+1)
Studies of symptoms, brief etiology, perpetuation, epidemiology and control of following diseases: Citrus: Canker, Tristeza, root rot; Mango: Malformation, Anthracnose, Black tip; Banana: Panama wilt, Sigatoka, Bunchy Top; Grape: Downy Mildew; Pineapple: fruit rot, Heart rot; Papaya: Papaya mosaic, Papaya ring spot, Papaya leaf curl; Guava: Guava wilt; Apple: Scab, fire blight; Damping off of Vegetables; Chilli: Anthracnose, leaf curl; Bhindi: YVMV; Brinjal: Wilt, Phomopsis blight, Sclerotinia foot rot, Little leaf of brinjal; Potato: Late blight, early blight, wilt, scab, wart, mosaic; Tomato: Late blight, early blight, leaf curl; Beans: Anthracnose; Pea: rust, powdery mildew; Crucifers: Downy mildew, club rot, black rot, Boron and Molybdenum deficiency; Cucurbits: Powdery mildew, downy mildew, anthracnose, mosaic; Onion/garlic: Stemphyllium blight, rust; Coconut: Bud rot, Ganoderma wilt; Beetlevine: Phytophthora fruit and root rot; Coffee: Rust; Tea: Blister blight, Red rust, grey and brown blight; Rose: dieback, blick spot; Chrysanthemum: Septoria leaf spot, Basal stem rots; Ginger: Rhizome rot; Coriander: Stem gall.
Practical: Field visit and acquaintance with disease of crops, study of pathogens where possible; important diseases are: Late blight of potato, Wilt of Tomato, Anthracnose of beans, powdery mildew of pea, Rhizome rot of Ginger, Stem gall of coriander, powdery mildew, Downy mildew of cucurbits, Stemphylium blight, Rust of onion and garlic; Dieback of rose. Acquaintance with common fungicides and their methods of application.

PPA – 351: Diseases Horticultural Crops and their management- II 3 (2+1)
Study of symptoms, brief etiology, epidemiology and control of following diseases: Jasmine: Leaf blight, Rust; Marigold: leaf spot and bud rot; Tuberose: foot and tuber rot, Blossom blight; Gerbera: Blossom blight, powdery mildew; Gladiolus: Corm rot, Flower rot; Anthurium: Anthracnose, bacterial blight; Pomegranate: Bacterial leaf spot, anthracnose; Ber: Powdery mildew; Sapota: Leaf spot; jack fruit: Rhizopus rot; Pear: Fire blight; Peach: Leaf curl; Almond: Bacterial gummosis; Walnut: Dieback; Strawberry: one important disease; Cashew: damping off, die back; Rubber: abnormal leaf fall, bark canker, stem rot; Cocoa: Black pod, stem canker, Vascular streak; Fenugreek: powdery mildew, downy mildew, rust; Black pepper: foot rot and quick wilt, anthracnose; Cumin: powder mildew, wilt; Turmeric: Rhizome rot, Leaf blotch; Cardamom: Katte, Capsule rot, chirke, foorke; Nutmeg: Fruit rot; Clove: Leaf spot and die back, Grey blight, Senna: Damping off; Rauwolfia: Cercospora leaf spot; Pyrethrum: Leaf blotch, grey mould; Cinnamon: leaf rot; Belladona, Ipecac, Stevia, Discoria, Mint: Powdery mildew, Leaf spot; Opium: Downy mildew.

Practical: Field visit and acquaintance with diseases of crops, study of pathogens where possible; important diseases are: Leaf spot of Marigold, Blossom blight of tuberose, Corm rot Gladiolus, Rhizopus rot of jackfruit, anthracnose of black pepper.

Department of Agril. Entomology

ENT 151: Nematode Pests of Horticultural Crops and their Management 2 (1+1)
ENT-201: Fundamentals of Entomology 3 (2+1)
ENT-302: Apiculture 1 (0+1)
ENT 351: Insect pests of horticultural crops & their management 3 (2+1)

ENT 151: Nematode Pests of Horticultural Crops and their Management 2 (1+1)
History of development of nematology - definition, economic importance. General characters of plant parasitic nematodes, their morphology, taxonomy, classification, biology, symptomatology and control of important plant parasitic nematodes of fruits – (tropical, subtropical and temperate) vegetables, tuber, ornamental, spice and plantation crops. Role of nematodes in plant disease complex.

Practical: Methods of sampling and extraction of nematodes from soil and plant parts, killing, fixing and preparation of temporary and permanent nematode mounts. Nematicides and their use. Collection and preservation of 20 plant species/parts damaged by plant parasitic nematodes.
ENT- 201: Fundamentals of Entomology 3 (2+1)


Practical:
- Method of collection and preservation of insects including immature stages.
- External features of Grasshopper/Blister beetle
- Types of insect antennae, mouthparts and legs.
- Wing venation, types of wings and wing coupling apparatus.
- Types of insect larvae and pupae.
- Dissection of digestive system in insects.
- Dissection of male and female reproductive system in insect.
- Study of characters of orders Orthoptera, Dictyoptera, Neuroptera and Odonata.
- Study of characters of order isopteran, Thysanoptera, Hemiptera, Lepidoptera, Coleoptera, Hymenoptera, dipteran and their families.

ENT- 251: Insect ecology & integrated pest management including beneficial insects 3 (2+1)


**Beneficial insects**- parasites and predators used in pest control and their mass multiplication techniques. Important group of microorganism—bacteria, viruses and fungi used in pest control and their mass multiplication techniques.

**Practical:**
- Visits to meteorological observatory/automatic weathers reporting station.
- Study of terrestrial and pond ecosystem of insects.
- Studies on behaviour of insect and orientation (repellency, stimulation, deterancy).
- Study of distribution pattern of insects, sampling techniques for the estimation of insect population and damage.
- Pest surveillance through light traps, pheromones traps and field incidence
- Practicable IPM practices—Mechanical and physical methods.
- Practicable IPM—Cultural and Biological methods.
- Chemical control—insecticides and their formulations
- Calculation of doses/concentration of insecticides.
- Compatibility of pesticides and phytotoxicity of insecticides
- IPM case studies
- Identification of common predators and their morphological characters
- Identification of common parasites and their morphological characters.

**ENT-302: Apiculture 1(0+1)**

**Practical:** Importance and history of apiculture, different species of bees, morphology, anatomy, colony organization and life cycle, bee-keeping equipment, social behaviour, reproduction, queen rearing, bee pastureage, seasonal management, economics of beekeeping. Bee enemies, diseases of bees, role of bees in increasing the productivity of horticultural crops in India economy, bee products and their uses. Recent trends in apiculture. Acquaintance with honey bee species, morphology, structural adaptation, biology—castes—bee-keeping equipment, bee pastureage plants. Collection and preservation of bee flora, enemies and diseases of bees. Handling of bee colonies and manipulation for honey production.

**ENT 351: Insect pests of horticultural crops & their management 3(2+1)**

General—economic classification of insects; ecology and insect-pest management with reference to fruit, plantation, medicinal and aromatic crops; pest surveillance. Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting tropical, sub-tropical and temperate fruits, plantation, medicinal and aromatic crops like coconut, areca nut, oil palm, cashew, cacao, tea, coffee, cinchona, rubber, betel vine senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, Solanum khasianum and Tephrosia. Storage insects—distribution, host range, bioecology, injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products. Toxicology—insecticide residue problems in fruit, plantation, medicinal and aromatic crops and their tolerance limits.
Economic importance of insects in vegetable, ornamental and spice crops - ecology and pest management with reference to these crops. Pest surveillance in important vegetable, ornamental and spice crops. Distribution, host range, bio-ecology, injury, integrated management of important insect-pests affecting vegetable, ornamental and spice crops. Important storage insect-pests of vegetable, ornamental and spice crops, their host range, bioecology, injury and integrated management. Insect–pests of processed vegetables and ornamental crops, their host range, bio-ecology, injury and integrated management. Insecticidal residue problems in vegetables and ornamental crops, tolerance limits etc.

**Practical:** Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of important insect–pests affecting fruits, plantation, medicinal and aromatic crops in field and storage. Study of symptoms, damage, collection, identification, preservation, assessment of damage/population of important insect-pests affecting vegetable, ornamental and spice crops in field and during storage.

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**Department of Soil Science and Agril. Chemistry**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>SSC 101</td>
<td>Introductions to Soil Science</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>SSC 152</td>
<td>Agricultural Microbiology</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>SSC 251</td>
<td>Soil Science-I (Soil Chemistry, Soil Fertility and Fertilizer)</td>
<td>3(2+1)</td>
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<tr>
<td>SSC-352</td>
<td>Remote Sensing and Geographical Information System for Natural Resource Management and Land Use Planning</td>
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**SSC 101 Introductions to Soil Science** (2+1)

Pedological and Edaphological concept: Definition of Pedology and Edaphology, Difference between Pedology and Edaphology, Definition of pedon, poly pedon etc. Origin of the earth, Earth’s crust: Solar system concept, Evolution of earth, Different spheres of the earth-concept, definition, composition, dimension etc., Earth’s crust, mantle and core-concept, definition, composition, dimension etc. Rocks and minerals-classification and composition: Definition of rocks and minerals, Monominalanic and polymineralanic rocks-definition and examples, Definition of Petrography and Petrogenesis, Rock formation-factors, Classification of rocks – igneous rock- classification of igneous rock, Metamorphic rock and Sedimentary rock-definition, classification, examples, Weathering of rocks and minerals, Weathering of rocks-definition, types of weathering- physical, chemical & biological weathering with example Parent materials and its classification: Definition, Secondary and primary minerals: description with examples, Soil formation-factors and processes: Soil formation: Dockuchaiev, Jenny concept, soil forming factors: passive & active factors, age of soil, Fundamental processes of soil formation, Different process of soil formation like podzolization, laterization etc. Soil profile, Definition of soil profile, horizon, different types of horizon with characters. Soil Texture – Soil separates (fine earth),
classification of soil separates, coarse or rock fragments, major characteristics of soil separates. Definition of Soil Texture, soil textural classes, alteration of soil textural classes, adjustment of land use to soil textural classes, heavy soils and light soils and their physical problems. Importance of soil texture, relation between soil texture and other soil properties.

Soil Structure – Definition and classification of soil structure, difference between soil texture and soil structure, soil aggregation and aggregate formation. Important/agricultural significance of soil structure, management of soil structure.

Soil Densities – Bulk density - Definition and factors affecting bulk density. Particle Density – Definition and factors affecting particle density, difference between bulk density and particle density.

Pore space – Definition and factors affecting porosity of soil, relation between bulk density, particle density of soil, and total porosity of a soil, size of pores, factors affecting size of pores, void ratio, air filled porosity, fractional air content and other relation between various parameters related to density and porosity of soil.

Numericals

Soil colour - Definition, description, causes, importance/significance of soil colour, determination and interpretation of soil colour. Soil Water: Properties and Behaviour – Molecular structure of water and ice, density, surface tension, contact angle, capillarity, viscosity, vapour pressure, freezing and thawing, vaporization and condensation, heat capacity, dielectric constant of water, attraction of water to solids and to inorganic ions, water as a solvent. Importance of water in agriculture, behaviour of water in soil, Retention of soil water in the field, very brief ideas about soil water potential, soil moisture constants and factors affecting soil moisture constants.

Soil water Classification – Physical classification along with the factors affecting various kinds of physical classification and biological classification. Available water - definition, concept and factors affecting available water. Numericals

Soil Air – Composition of soil air, idea on soil aeration and gaseous exchange between soil and atmosphere, Importance of various components of soil air.


Layer silicate clays, their genesis and sources of charges. Structure of layer silicate clays(1: 1, 2:1,2:2 type), comparative properties of silicate clay minerals, genesis and sources of negative charges on silicate clay, organic soil colloids. Absorption of ions, concept of ion exchange phenomena, CEC, ECEC, AEC, factors affecting ion exchange, milliequivalent concept, percentage base saturation, Importance of cation exchange in plant nutrition, contact exchange, root CEC, complementary ion effect, pH and buffering, buffering capacity of soil, relation between pH-dependent and permanent charge.

Characteristic and reclamation of acid soil: distribution of acid soils, concept of soil acidity, sources of soil acidity, kinds of soil acidity, problems of soil acidity, reclamation of acid soil, liming materials, calculation of CCE, chemical reactions between liming materials and acid soils, lime requirement (LR) and liming factor, effect of overliming, effects of lime on soil properties in relation to plant nutrition, acid sulphate soil.
and reclamation of salt affected soil: Concept of salt affected soil (saline, alkali, black alkali, saline alkali, degraded alkali or sodic), sources of soluble salts, characteristics of salt affected soils. Formation of salt affected soils (saline, alkali or sodic, saline-alkali), SAR, ESP. Reclamation of saline and alkali or sodic soils, Gypsum requirement (GR), Leaching Requirement (LR). Soil organic matter, composition and function, decomposability, factors affecting decomposition and humus formation, fractionation of soil organic matter, C:N and its significance, priming action.

B) Practical class outline:

1. Collection and processing of soils,
2. Determination of soil pH by lovibond comparator and pH meter,
3. Determination of ECs of the given soil
4. Determination of B.D. and P.D.
5. Soil moisture determination,
6. Determination of Maximum water holding capacity,
7. Determination of soil texture by feel method,
8. Determination of Soil temperature,
9. Determination of Water quality analysis,
10. Identification of rocks and minerals.
11. Analytical Chemistry- basic concepts, techniques & calculations.

SSC 152 Agricultural Microbiology (2+1)

Introduction: Definition, scope and applied areas of microbiology; History and Development of Microbiology: The discovery of microorganisms, Spontaneous generation conflict, Germ theory of diseases, Role of microbes in fermentation, Development of soil microbiology; Position of microorganisms in the living World: Protista, Procaryotes and eukaryotes, Whattacker five kingdom classification; Microscopy and specimen preparation: Bright field microscope, Simple and differential staining: smear preparation, fixation, mordant application etc.; Procaryotic cell structure and function: Structure and function of capsule, flagella, cell wall, cytoplasmic membrane, mesosome, cytoplasm, ribosome, reserved food materials etc.; Growth of microorganisms: Definition of growth, Bacterial, yeast and fungal growth curve, Synchronous growth of bacteria, Measurement of bacterial growth, Nutrition and Culture media: Classification of microorganisms based on nutrition, function of nutrients, nutrients required for microorganisms, classification of culture media, classification of microorganisms based on temperature and oxygen requirement.; Bacterial metabolism: ATP generation (substrate level phosphorylation, oxidative phosphorylation and chemiosmosis), ATP generation by heterotrophic bacteria (respiration and fermentation) and autotrophic bacteria (chemoautotrophy and photoautotrophy);
**Bacteriophages**: Properties and structure of bacterial viruses, Lytic and lysogenic cycles, viroids, prions.; **Soil Microbiology**: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur, biological nitrogen fixation. Microflora of rhizosphere and phyllospheremicroflora, microbes in composting.;

**Beneficial microorganisms in Agriculture**: Biofertilizer (Bacterial, Cyanobacterial and fungal), microbial insecticides, microbial agents for control of plant diseases, Biodegradation, Biogas production, Biodegradable plastics, plant- microbe interactions.

**B) Practical class outline:**

1. General instructions,
2. Familiarization with instruments,
3. materials, glassware etc. in a microbiology laboratory:
4. Practice of Aseptic methods: (i) Evaluation of aseptic technique with nutrient broth tubes.
5. Evaluation of aseptic technique with a nutrient agar plate,
6. Methods of sterilization and preparation of media: (i) Preparation of nutrient broth, nutrient agar plates, nutrient agar slants,
7. Sterilization of glassware by dry heating,
8. Sterilization of nutrient broth by Filtration.;
9. Plating methods for isolation and purification of bacteria :
10. Isolation of bacteria by streak plate method,  
11. Checking of purity of a bacterial culture by streak plate method. Morphological examination of bacteria by simple and differential staining;

**SSC 251 SoilScience-I (Soil Chemistry, Soil Fertility and Fertilizer) (2+1)**

Soil as a source of plant nutrients, essential and beneficial elements, criteria of essentiality, forms of nutrients in soil, exchange and fixation of nutrients(N,P,K) in soils, factors affecting fixation of nutrients, agricultural significance, Mechanism of nutrient transport to plants.;

Macronutrients(N,P,K,Ca,Mg,S) – occurrence, sources, forms, transformation and availability in soil and plant nutrition, function in plants, problems on availability in soil and plants and corrective measures.; Micronutrients(Fe,Mn,Cu,Zn,Mo,B) – sources, forms in soils, functions in plants, factors influencing availability in soil and its management, nutrient transformation under submerged soils.; Soil Fertility- different approaches for soil fertility evaluation-chemical and biological. Plant analysis-DRIS method, critical level in plants, rapid tissue tests, indicator plants.;Manures: definition, difference from fertilizers,Classification of manures with examples (Bulky, concentrated, bio-fertilizers etc.),Characteristics of manures, FYM- definition, characteristics

B) Practical class outline:

1. Determination of Soil organic carbon,
2. Determination of soil pH by pH meter,
3. Estimation of available N in soil and plant extract
4. Estimation of available P in soil and plant extract
5. Estimation of available K in soil and plant extract
6. Estimation of available S in soil and plant extract
7. Estimation of available Ca and Mg in soil and plant extract
9. Rapid test of ammoniacal & nitrate nitrogen for nitrogenous fertilizer, water soluble P2O5 for phosphatic, K for potassic fertilizers,
10. Determination of COD in organic wastes,
11. To check the adulteration in fertilizers.

SSC- 352 Remote Sensing and Geographical Information System for Natural Resource Management and Land Use Planning 3(1+2)

Remote Sensing: Introduction to remote sensing and aerial photography; Definition and principles of remote sensing; Energy sources and radiation principles; Nature of electromagnetic and thermal radiations; Active and passive remote sensing systems; Propagation of radiations through the atmosphere; Atmospheric window; Types of remote sensors and scanners; Satellite data products; Spatial, temporal, spectral, and radiometric resolutions; Spectral signature of different earth features; Remote sensing in optical infrared region for study of vegetation, soil, and water; Crop stress detection and crop yield...
modeling; Vegetation indices. Background and history of Indian space programme; Satellite imageries; Digital image processing: Image pre-processing, image processing, and image transformation; Image interpretation:True colour. Pseudo colour, and False colour compositions; Image classification: Supervised and unsupervised classifications. Global Positioning System (GPS): Introduction and applications of GPS navigation techniques; GPS satellites; Segments of GPS systems; Principles of GPS navigation; GPS broadcast signals; Accuracy of GPS systems; Sources of error in GPS; Error corrections; Pseudo range and differential GPS systems. Geographic Information System (GIS): Definition and objectives; Components of GIS; Types of data: Geographic and attribute data; Data structures in GIS: vector and raster based data models; Analysis tools in GIS: Buffer analysis, overlay analysis, and network analysis. Natural Resource Management and Land Use Planning: Objectives, methods, and interpretation of land use planning; Applications of geoinformatics for natural resource management and land use planning.

Practical:

Familiarization with remote sensing and GIS equipments, softwares (ERDAS Imagine/Geomatica/ENVI; IDRISI/Arc Info/Arc View/Arc GIS), and data products; Topographic sheets; Creation of data files in a geographic database system; Onscreen digitization technique; Map projections; Image interpretation and enhancement techniques; Supervised and unsupervised classifications; Distance and area measurement; Soil survey and interpretation of satellite imageries, topographic sheets, and reports towards natural resource management and land use planning.

Department of Agril. Engineering

AEN- 201: Farm Power, Machinery and Renewable Energy 3 (2+1)


Practical: Study of different components of I.C. Engine; Study of working of four stroke
engine; Study of working of two stroke engine; Study of M.B. plough, measurement of plough size, different parts, horizontal and vertical suction, determination of line of pull etc.; Study of disc plough; Study of seed-cum-fertilizer drills-furrow opener, metering mechanism, and calibration; Study, maintenance and operation of tractor; Learning of tractor driving; Study, maintenance and operation of power tiller; Study of different parts, registration alignment and operation of mower. Study of different inter cultivation equipments in terms of efficiency, field capacity; Repairs and adjustments and operation of sprayers; Repairs and adjustments and operation of clusters; Study of paddy transplanters. Constructational details of KVIC&Janatha type biogas plants; Constructional details of DeenBandu type biogas plants; Field visit to biogas plants; Briquette preparation from biomass; To study and find the efficiency of solar cooker; To study and find the performance of a solar still; Study and performance evaluation of domestic solar water heater; Study and performance evaluation of solar lantern; Field visit to wind mills; To study the processing of Bio- diesel production from jatropha.

Department of Agril. Statistics

AST- 151: Fundamental of Statistics (2+1)
AST- 152: Elements of Computer Application 2 (1+1)
AST- 201: Fundamentals of Statistics- II 2 (1+1)

AST- 151: Fundamental of Statistics (2+1)

Concept of Statistics; Frequency Distribution of Ungrouped and Grouped data; Measures of Central Tendency: AM, GM, HM, Median, Mode, Quartiles, Percentiles; Measures of Dispersion: Range, Mean Deviation, Standard Deviation, Coefficient of variation, Coefficient of Mean Deviation, Coefficient of Quartile Deviation; Moments, Skewness, Kurtosis. Elementary set Theory; theory of Probability: Probability: Definitions (Class, Axiomatic) of Probability; Theorem on Total and Compound Probability (For two events only with proof), Pair wise and Mutual Independence of Events; Random variable. Probability Mass Function and Probability Density Function Expectation and Variance; Theoretical Distributions: Binomial Distribution, Poisson Distribution and Normal Distribution; Central Limit Theorem (Statement only). Statistical Methods: Simple Correlation and Regression.

Practical: Construction of frequency distribution from ungrouped data; Calculation of different measures of Location and Dispersion and the measures of Skewness and Kurtosis. Calculation of simple correlation coefficient; Method of prediction through fitting of linear regression equations; fitting of binomial distribution, Poisson distribution and normal distribution.

AST- 152: Elements of Computer Application 2 (1+1)

**AST- 201: Fundamentals of Statistics- II 2 (1+1)**

Samples survey: Basic concept and preliminaries of sampling theory; Advantages of sample survey over census-survey; Random Sampling (SRS), SRSWR and SRSWOR; Estimates of population Mean; Total and their variances (formulae only) for SRS; Concepts of sampling Errors and non-sampling errors.

Concept of Statistical hypotheses, Critical region, Acceptance region, Level of Significance; Type-I Error, type-II Error, Power of a Test and Test of Significance; Applications of T, t, χ² and F statistics. Design of experiment: concept and different terms of experimental designs; Fundamental principles, Uniformity trial, fertility contour map; Analysis of Variance one way and two way classified data (Equal observation / cell); Layout and Analysis of CRD, RBD and LSD.

**Practical:** Drawing of random samples using SRSWOR a destination of mean, Total and their standard errors and confidence intervals. Application of T, t, χ² and F statistics for test of significance in different statistical problems.

Layout Of COO, RBD, and LSD. Analysis of data from experiments laid out in CRD, RBD and LSD.

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**BCH- 201: Biochemistry 3(2+1)**

Biochemistry - Introduction and importance. Biomolecules - Structure, properties & applications: Carbohydrates (occurrence, classification, structure, optical isomerism and optical activity, physical and chemical properties - reducing property, reactions with acids and alkalis, osazone formation). Amino acids, peptides and proteins (classification and structure essential amino acids, properties of amino acids, colour reactions, amphoteric nature isomerism, structure of proteins - primary, secondary, tertiary and quaternary; properties and reactions of proteins). Enzymes (classification and mechanism of action, factors affecting enzyme action, vitamins and minerals as co-factor and coenzymes). Nucleotides and Nucleic acids (Structure and functions). Lipids (classification, Important fatty acids and triglyceraldehydes, essential fatty acids, physical and chemical properties of oils, their rancidity, phospholipids, types and importance). Plant pigments - structure and function of chlorophyll and, carotenoids, sterols, basic structure, role of brassinosterols in plants. Metabolism - glycolysis, citric acid cycle, oxidative phosphorylation, bioenergetics of glucose; fatty acid oxidation, bioenergetics of fatty acids and lipid biosynthesis; protein synthesis - replication, transcription and translation.

**Practical:**
Models of sugars, sucrose and starch (atomic and paper), amino acids models (atomic) and paper model of protein, fatty acid model. Preparation of standard solutions and reagents. Carbohydrates- qualitative reactions, estimation of starch, reducing and non-reducing sugars, quantitative determination of sugars after removal of interfering substances, paper chromatography for the separation of sugars. Protein denaturation- heat, pH, precipitation of proteins with heavy metals, immune reaction, reaction of proteins, protein estimation by Lowry method. Enzyme kinetics, competitive inhibition, enzyme immobilization, enzyme

Department of Agril. Economics

**ECO- 151: Introductory Economics 2 (2+0)**

**ECO- 352: Horti- Business Management 2 (2+0)**

**ECO- 151: Introductory Economics 2 (2+0)**

**ECO- 352: Horti- Business Management 2 (2+0)**
EXT- 101: Fundamentals of Extension Education 2(1+1)

EXT – 351: Entrepreneurship Development 2 (1+1)

EXT- 101: Fundamentals of Extension Education 2(1+1)


Practical: Visits to study structure, functions, linkages and extension programmes of ICFRE institutes/voluntary organizations/MahilaMandal, Village Panchayat, State Deptt. of Forests/All India Radio (AIR). Exercises on distortion of message, script writing for farm broadcasts and telecasts, planning, preparation & use of NPVA like poster, chart, flash cards, folders etc. and AVA like OHP & 35 mm slide projector transparencies. Identification of local leaders to study their role in extension work. Evaluation of some selected case studies of forestry extension programmes. Preparation of Village Agricultural productions plan.

EXT –351: Entrepreneurship Development 2 (1+1)

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to horticulture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of horticulture industry. Characteristics of Indian horticultural processing and export industry. Social Responsibility of Business. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and
technical articles, precis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

**Practical:** Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting; individual and group presentations.

**Other Courses**

**AG 101: Communication Skills in English (NC) 2 (1+1)**

Structural Grammar: Introduction of Word Classes; Structure of Verb in English; Uses of Tenses; Study of Voice; Study of Conjunctions and Prepositions; Sentence Patterns in English. Spoken English: Conversations of different situations in everyday life; the concept of stress; stress shift in words and sentences; silent letters in words and pronunciation of words with silent letters, the basic intonation patterns. Practical: Structural Grammar: Exercises in word classes, identification and study of verbs in sentences, application of tenses and voice, exercises in conjunctions and prepositions, other structural grammar exercises, report writing, letter writing (different types of letters). Spoken English: Conversations of everyday life, the concept of stress; stress shift. Silent letters in words, basic intonation patterns, preparing and address.

**AG 102: Physical Education (NC) 1 (0+1)**

NSS: orientation of students in national problems, study of philosophy of NSS, fundamentals rights, directive principles of state policy, socio-economic structure of Indian society, population problems, brief of five year plan. Functional literacy, non-formal education of rural youth, eradication of social evils, awareness, highlight of consumer act. Environmental enrichment and conservation, health. Family welfare and nutrition. NCC: introduction to NCC, defence services, system of NCC training, foot drill, sizing, forming up in three rank, open and close order march, dressing, getting on parade, dismissing and falling out, saluting, marching, arms drill, shoulder arm, order arm, present arm, guard of honour, ceremonial drill, weapon training- rifle bayonet, light machine gun, sten machine carbine, introduction and characteristic stripping, assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging, fire discipline and fire control order, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush, field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self defence, general principles, precautions and training, attacks and counter attacks, marching and searching, first aid, hygiene and sanitation, civil defence, leadership and NCC song. Physical education: introduction to physical education. Posture, exercise for good posture, physical fitness exercise for agility, strength, coordination, endurance and speed. Rules and regulation of important games, skill development in any one of the game- football, hockey, cricket, volleyball, ball badminton,
throw ball, tennikoit. Participation in one of the indoor game – shuttle badminton, chess and table tennis. Rules and regulation of athletic events, participation in any one of the athletic event – broad jump, high jump, triple jump, javelin throw, discuss throw, shot put, short and long distance running, safety education, movement education, effective way of doing day-to-day activates. First-aid training, coaching for major games and indoor games. Asans and indigenous ways for physical fitness and curative exercises. Exercises and game for leisure time, use and experience. Note: warming up and conditioning exercises are compulsory before the commencement of each class.

**EL-401: Expriential Learning (EL)** 20 (0+20)

Under this programme, the students will undergo hands on training based on the concept of “earn while you learn” adopting an end to end approach (production to marketing).

The students will choose one programme out of the following two programmes (Modules):
1. Commercial Horticulture
2. Protected cultivation of high value Horticultural crops

**Rural Horticultural Work Experience (RAWE)** 10 (0+10)

Under RAWE, students will be required to stay in the villages along with the farmers to have a deeper insight into the rural life and will study the village profile i.e. literacy, nutritional habits, socio-economic status, status and potential of Horticulture, Technological gaps, various developmental schemes run by the government and NGOs working in that area etc. The students will maintain the daily work sheet to be evaluated weekly by evaluation committee in consultation with the local bodies.

**Industrial training (IT)** 10 (0+10)

The students will be attached with the related industry (ies) where they will work under the real life situations. This will give them opportunity to critically examine the weaknesses and gaps in their chosen programmes. The progress of the students will be monitored and evaluated jointly by the representatives of the concerned industry and the committee constituted for this purpose by the University in the weightage of 75:25.