**Faculty of Agricultural Sciences (IAS)**
**Siksha 'O' Anusandhan, Deemed to be University**

# M. Sc. (Ag.) in Horticulture

## Programme Outcome:

- Enriched knowledge on recent developments in soil and crop management with respect to improvement and productivity, water and nutrient management and their interaction with integrated approach and the disease and pest management in integrated manner. The economic indices on package of practices develop and their transfer to farmers makes the students eligible for advanced studies at doctoral level.
- With specialized knowledge in a particular discipline of agricultural sciences, the students are worth to be absorbed in different fields of academics, research and extension under different organizations.
- Agriculture being the applied science, the skills as developed in the fields of crop improvement, crop production, crop protection and social science fields makes the students an asset for taking up the assignments both at organizational and field level.
- The knowledge, skill and expertise gained during the `study of course curriculum provides an opportunity to take up entrepreneurships holistically as a joint venture.

## Programme Specific Objective:

**1)** The objective is to equip the students to apply knowledge of various plant groups and their growth, development and reproduction specially with reference to Horticulture plants

**2)** To train the students and also sensitize them for research.

## Programme Specific Outcome (PSO):

**1)** The students would also be able to explain production technology for local fruits, vegetables, spices, medicinal plants and plantation crops.

**2)** Advanced knowledge and skills necessary to function as a creative and professional practitioner, communicator, educator, or investigator in the field of horticulture.

**3)** Intellectual means of identifying and assessing the interactions among the many issues associated with horticulture and society at large.

**4)** Skills and intellectual means of contributing new knowledge to the profession of horticulture

## Major Courses

**Hort-501 - Horticultural Plant Propagation and Nursery Management (1+1)**

**Objective:**

- The course is aimed to understanding the basic concept and physiology of different propagation method, tissue culture technique and nursery management of horticultural crops.

**Outcome:**

- To know about basic concept and principles of plant propagation
- To get a clear idea about nursery management, rootstock and scion relationship.
- To know about the different propagation methods of horticultural crops.

**Hort-502 - Principles and Production of Vegetables Crops (2+1)**

**Objective:**

- The objective of this course is to provide about various botanical classification of vegetable crops
- To know about the advance production technology of vegetable crops.

**Outcome:**

- To get idea about the nursery raising of different vegetable.
- Identification of different varieties of vegetable, pest, diseases and physiological disorders of vegetable crops.

**Hort-503-Principles of Landscaping and Production Technology of Ornamental Plants (2+1)**

**Objective:**

- The aim of this course is to provide insight into various about identification, production technology and processing of different Spices, Aromatic, Medicinal Crops and Landscape plants.

**Outcome:**

- Knowledge on floriculture and landscaping, gardening style and designs, bio-aesthetic planning, indoor gardening, packaging and marketing techniques of crops.
- This course will helpful to the student about preparation of bonsai and flower arrangement.

- Improving our knowledge about these crops through various field visits.

**Hort-504 - Horticultural Biotechnology (1+1)**

**Objective:**

- Understanding the principles, theoretical aspects and developing skills in biotechnology of horticultural crops.

**Outcome:**

- Student will know about the tissue culture techniques like micro propagation, somaclonal variation, Invitro mutagenesis, protoplast culture, somatic hybridization, micro grafting, genetic transformation technique,
- To get a brief idea about the production of bio-agent and bio-fertilizer, nutrient media, inoculation of explant, protoplast isolation

**Hort-505 - Nutrition of Horticultural Crops 1+1**

**Objective:**

- The sole objective is to get knowledge of nutrition of horticultural crops, techniques of diagnosis of mineral nutrient deficiency in fruits, vegetables, ornamental, plantation crops, techniques on root distribution in fruit crops

**Outcome:**

- This course helps to identifying the different symptoms of nutritional disorders and their diagnosis.
- It helps to get a clear idea about leaf sampling techniques, analysis of sample and root distribution pattern in fruit crops.
- It helps to understanding the effect of nutrition on growth, yield and quality of horticultural crops.

**Hort-506 - Growth and Development of Horticultural Crops 2+1**

**Objective:**

- The objective of this course is to impart knowledge about physiology, bio chemistry and morphogenesis of horticultural crops.
- To get a clear cut idea about growth regulator, synthesis, action and its effect on plant growth and development.

**Outcome:**

- Knowledge regarding growth dynamics, Bio-synthesis of growth regulators, inhibitor, application techniques of growth regulating substances.

- Idea about induction of parthenocarpic fruits and techniques of breaking of dormancy of seed.

**Hort-507 - Principles and Production of Fruit Crops**

**2+1**

**Objective:**

- This course is aimed at understanding the basic concepts of production technology on tropical, sub-tropical and minor fruit crops.
- To impart knowledge about unfruitfulness associated with internal and external factors of fruit crops.

**Outcome:**

- This course will helps for student to understand package and practices of fruit crops.
- Students will able to identify the different varieties of fruit crops.
- Student will understand about the special cultural methods such as training and pruning.
- Students will get a clear idea about the cost of cultivation of fruit crops.

**Hort-508: Principles of Post- harvest Management and Processing of Horticultural Crops (2+1)**

**Objective:**

- To get knowledge about nature, structure and composition of different horticultural crops.
- To study about the Maturity, harvesting, grading, packaging and other post harvest handling of perishable horticultural produces.
- To study about the different Post harvest treatments for improving the shelf life of horticultural produces.

**Outcome:**

- Student will understand the different post harvest technology.
- Students will get knowledge about the preparation of different products such as jam, jelly, tomato sauce and ketch up etc.
- Field visits to different storage units, factory and processing unit to improve their knowledge.

**Hort-509 - Breeding of Vegetable and Ornamental Crops 2+1**

**Objective:**

- The aim of this course is to know different breeding objectives and breeding methods in vegetable and ornamental crops.
- To know about the male sterility and self incompatibility problems regarding vegetable and ornamental crops.

**Outcome:**

- This course will helps for the student to know about the floral biology of vegetables and ornamental crops.
- Students will get knowledge about the different breeding methods followed in vegetable and ornamental crops.

**Hort-510 Fruit and Plantation Crop Breeding 2+1**

**Objective:**

- To impart comprehensive knowledge about the principles and practices of breeding of fruit and plantation crops.

**Outcome:**

- Students will know the different breeding method for fruit and plantation crops.
- Student will understand the reproductive biology of cultivars
- Knowledge about the markers used in fruit and plantation crops.

**Hort-511 Medicinal, Aromatic, Plantation Crops and Spices Production (2+1)**

**Objective:**

- To know about the difference between medicinal, Aromatic, Plantation crops and Spices.
- To impart basic knowledge about the production technology of these crops.

**Outcome:**

- This course helps for identifications of medicinal, aromatic, plantation and spice crops.
- Student will know about the package and practices of these crops.
- To develop effective ideas related to harvesting, processing and extraction of oils from medicinal, aromatic, plantation and spice crops.

**Hort-512 Vegetable and Flower Seed Production Technology 2+1**

**Objective:**

- To know about the vegetable and ornamental seed industry in India and World.
- This course imparts knowledge on hybrid seed production in vegetable and ornamental crops.

- To know about the role of climatic and adaphic factor on seed production.

**Outcome:**

- To develop idea about the production and maintenances of nucleus, breeder, foundation and certified seeds.
- Students will understand about the agro techniques followed in vegetable and ornamental crops for seed production.
- This course helps for the student to understand about IPR and WTO in relation to vegetable and ornamental crops seed production.

**Hort-513: Laboratory Techniques and Research Methodology in Post-harvest Technology**

**2+1**

**Objective:**

- To know about the different techniques for food analysis.
- To facilitate deeper understanding about the chromatography, spectrophotometer, NMR, flame photometer etc.

**Outcome:**

- To understand the role of instruments in food industry.
- Student will get a clear idea about the principle and method of food analysis instruments such as chromatography, spectrophotometer, NMR, ESR, amino acid analyzer etc.

**Hort-514 Protected Cultivation of Vegetables 1+1**

**Objective:**

- Understanding the principles, theoretical aspects and developing skills in protected cultivation of vegetables.

**Outcome:**

- Knowledge on protected cultivation of vegetables, Fertigation, cover specific technology for raising vegetables, soil less culture, study of various type of glass house is the outcome of this course.

**Hort-515 Commercial Floriculture 1+1**

**Objective:**

- The aim of this course is to provide insight into advances in production technology and post-harvest handling various ornamental crops, orchids, cacti and various foliage plants. Different types of culture, bio-fertilizers, growth regulators, growth retardant.
- To know about the national and international floriculture industry.

**Outcome:**

- Student will know about the production technology of flower crops.
- This course helps to know about the different flower products, extraction of oil and pigments.
- Student will understand the different post harvest management including precooking, grading, packaging and storage of flowers.

**Hort-516 Orchard Management 1+1**

**Objective:**

- This course is aimed at understanding the basic concepts Knowledge on orchard management, soil management practices, techniques of training and pruning.

**Outcome:**

- Students will know about different methods of layout, selection of plants and planting, different method of irrigation.
- Different soil management practices on growth and productivity of fruit crops.
- Ideas regarding pet and diseases control in fruit crops.

**Minor Course**

**PBG 503 - PRINCIPLES OF PLANT BREEDING 2+1**

**Objectives:**

- This Course is aimed at understanding the basic concepts of genetics,
- Helps students to develop their analytical, quantitative and problem solving skills from classical to molecular genetics.

**Outcome:**

- Floral biology in self and cross pollinated species, selfing and crossing techniques. Selection methods in segregating populations and evaluation of breeding material.
- Analysis of variance (ANOVA); Estimation of heritability and genetic advance;
- Maintenance of experimental records; Learning techniques in hybrid seed production using male-sterility in field crops.

**PBG 511 BIOTECHNOLOGY FOR CROP IMPROVEMENT 2+1**

**Objectives:**

- To impart knowledge and biotechnological tools in crop improvement.

**Outcome:**

- Requirements for plant tissue culture laboratory-Techniques in plant tissue culture - Media components and media preparation, Inoculation of explants; Callus induction and plant regeneration.

**PL PATH 517 - POST HARVEST DISEASES 2+1**

**Objectives:**

- To acquaint with post harvest diseases of agricultural produce and their ecofriendly management.

**Outcome:**

- Isolation characterization and maintenance of pathogens, role of different storage conditions on disease development, application of antagonists against pathogens *in vivo* and *in vitro* conditions.
- Comparative efficacy of different chemicals, fungicides, phyto extracts and bioagents.

**ENT-507 - Biological control of crop pest and weeds 1 + 1**

**Objectives:**

- To train the students with theory and practice of biological control, mass production techniques and field evaluation of various biological control agents like parasitoids, predators and various entomo pathogenic microorganisms.

**Outcome:**

- Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers.
- Visits (only where logistically feasible) to bio-control laboratories to learn rearing and mass production of egg, egg-larval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds

**PP 503: Physiological and molecular responses of plants to abiotic stresses 2 + 1**

**Objectives:**

- To apprise the students regarding abiotic stress to plant and its molecular basis.

**Outcome:**

- Student will understand about the response of plants to abiotic stresses and factors affecting plant productivity.

- Basic principles of a crop improvement programme under stress, Interactions between biotic and abiotic stresses

**PP 504 - Hormonal regulation of plant growth and development 2+1**

**Objectives:**

- To apprise the students about structure function of plant growth regulator on growth and development of plant.

**Outcome:**

- Knowledge regarding the different plant growth regulators.
- Students get idea about role of plant growth regulator which influence on plant growth development.

**PP- 510 Mineral nutrition 2+1**

**Objectives:**

- Impart knowledge about physiological and molecular aspects of carbon reduction cycle and nitrogen assimilation.

**Outcome:**

- Overview of essential mineral elements, kinetics of nutrient uptake by plants. Biological actions influencing nutrient availability near the root system

**Supporting Subject**

**STAT- 510: EXPERIMENTAL DESIGNS 2+1**

**Objectives:**

- This course give concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

**Outcomes:**

- The student will get idea about uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law.
- Analysis of data obtained from CRD, RBD, LSD; Analysis of factorial experiments without and with confounding; Analysis with missing data; Split plot and strip plot designs.

**Non Credit course**

## PGS-501: LIBRARY AND INFORMATION SERVICES 0+1

**Objectives:**

- To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

**Outcome:**

- Student will know about library and its services.
- Role of libraries in education, research and technology transfer; Classification systems and organization of library

## PGS-502: TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1

**Objectives:**

- To equip the students/scholars with skills to write dissertations, research papers, etc

**Outcome:**

- Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications

## PGS-503 intellectual property and its management in agriculture 1+0

**Objectives:**

- The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

**Outcome:**

- Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs

## PGS-504 BASIC CONCEPTS IN LABORATORY TECHNIQUES 1+0

**Objectives:**

- To acquaint the students about the basics of commonly used techniques in laboratory.

**Outcome:**

- Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets;

washing, drying and sterilization of glassware

**PGS-505: Agricultural research, research ethics and rural development programmes 1+0**

**Objectives:**

- To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of government.

**Outcome:**

- Need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment

**PGS-506: DISASTER MANAGEMENT 1+0**

**Objectives:**

- To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

**Outcome:**

- Natural Disasters- Meaning and nature of natural disasters, their types and effects, Man Made Disaster, Disaster Management

| Name of the Course | Course Code | Course Outcomes | PROGRAMME OUTCOMES | | | | PROGRAMME SPECIFIC OUTCOMES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PO1 | PO2 | PO3 | PO4 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| Horticultural plant propagation and nursery managemnt | Hort-501 | CO1 | ✓ | | ✓ | | ✓ | | | | |
| | | CO2 | ✓ | ✓ | | | ✓ | ✓ | | | |
| | | CO3 | | | | ✓ | ✓ | | ✓ | | ✓ |
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| Principle and production of vegetable crops | Hort-502 | CO1 | ✓ | | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| | | CO2 | ✓ | ✓ | ✓ | | ✓ | | | | ✓ |
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| Principles of landscapping and production technology of ornamental plants | Hort-503 | CO1 | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| | | CO2 | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |
| | | CO3 | ✓ | ✓ | | | ✓ | | | | |
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| Horticultural biotechnology | Hort-504 | CO1 | ✓ | | ✓ | ✓ | ✓ | | | | ✓ |
| | | CO2 | ✓ | ✓ | | ✓ | ✓ | ✓ | | | ✓ |
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| Nutrition of horticultural crops | Hort-505 | CO1 | ✓ | ✓ | ✓ | | ✓ | | | | ✓ |
| | | CO2 | ✓ | | | | ✓ | | | | ✓ |
| | | CO3 | ✓ | ✓ | | | ✓ | | | ✓ | |
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| Growth and devlopment of horticultural crops | Hort-506 | CO1 | ✓ | | | | ✓ | | | | |
| | | CO2 | | ✓ | | | ✓ | ✓ | □ | | |
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| Principles and production of fruit crops | Hort-507 | CO1 | ✓ | | | | ✓ | ✓ | | | |
| | | CO2 | ✓ | | | | ✓ | | ✓ | | |
| | | CO3 | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ |
| | | CO4 | | ✓ | | ✓ | ✓ | | | | |
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| Principles of post-harvest management and processing of horticultural crops | Hort-508 | CO1 | ✓ | | | | ✓ | | | | |
| | | CO2 | ✓ | | | ✓ | ✓ | ✓ | | | ✓ |
| | | CO3 | | | ✓ | ✓ | ✓ | | | ✓ | ✓ |
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| Breeding of vegetable and ornamental crops | Hort-509 | CO1 | ✓ | | | | ✓ | ✓ | | | |
| | | CO2 | ✓ | | ✓ | ✓ | ✓ | | | | ✓ |
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| fruit and plantation crop breedings | Hort-510 | CO1 | ✓ | ✓ | | ✓ | ✓ | ✓ | | | ✓ |
| | | CO2 | ✓ | | | | ✓ | | | | |
| | | CO3 | ✓ | | | | ✓ | | | ✓ | |
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| | | CO1 | ✓ | ✓ | | | ✓ | ✓ | | | |

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| Medicinal, aromatic, plantation crops and spices production | Hort-511 | CO2 | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |
| | | CO3 | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ |
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| Vegetable and flower seed production technology | Hort-512 | CO1 | ✓ | | ✓ | ✓ | ✓ | ✓ | | | |
| | | CO2 | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| | | CO3 | | | ✓ | | | | ✓ | ✓ | ✓ |
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| Laboratory techniques and research methodology in post-harvest technology | Hort-513 | CO1 | ✓ | | ✓ | | ✓ | | | ✓ | |
| | | CO2 | | ✓ | ✓ | ✓ | | ✓ | | | ✓ |
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| Protected cultivation of vegetables | Hort-514 | CO1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
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| Commercial Floriculture | Hort-515 | CO1 | ✓ | | ✓ | ✓ | ✓ | | ✓ | | ✓ |
| | | CO2 | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| | | CO3 | ✓ | | | ✓ | ✓ | | | ✓ | ✓ |
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| Orchard Management | Hort-516 | CO1 | ✓ | | | ✓ | ✓ | ✓ | | | ✓ |
| | | CO2 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| | | CO3 | ✓ | | | | ✓ | | ✓ | ✓ | |
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| Biological control of crop pest and weeds | ENT-507 | CO1 | ✓ | | ✓ | | ✓ | ✓ | | | |
| | | CO2 | ✓ | | | ✓ | ✓ | | ✓ | | ✓ |
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| Principles of plant breeding | PBG-503 | CO1 | ✓ | | | | ✓ | | | | |
| | | CO2 | ✓ | | | | ✓ | | | | ✓ |
| | | CO3 | ✓ | | ✓ | ✓ | ✓ | | | | |
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| Post harvest diseases | PL PATH 517 | CO1 | ✓ | ✓ | | | ✓ | | | | ✓ |
| | | CO2 | ✓ | | | | ✓ | | | | |
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| Mineral nutrition | PP- 510 | CO1 | ✓ | ✓ | | | ✓ | ✓ | | | |
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| Hormonal regulation of plant growth and development | PP-504 | CO1 | ✓ | | | | ✓ | | | | |
| | | CO2 | ✓ | ✓ | | | ✓ | ✓ | | | |
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| Experimental Designs | STAT-510 | CO1 | ✓ | | | | ✓ | | | | |
| | | CO2 | | ✓ | | | | ✓ | | | ✓ |
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| Biotechnology For Crop Improvement | PBG-511 | CO1 | ✓ | ✓ | | ✓ | ✓ | ✓ | | | ✓ |
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| library and information services | PGS-501 | CO1 | ✓ | | | | ✓ | | | | ✓ |
| | | CO2 | | ✓ | ✓ | | | ✓ | ✓ | | |
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| Technical writing and communications skills | PGS-502 | CO1 | ✓ | ✓ | ✓ | | | | | | |
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| Intellectual property and its management in agriculture | PGS-503 | CO1 | ✓ | ✓ | ✓ | | ✓ | ✓ | | | |
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| Basic concepts in laboratory techniques | PGS-504 | CO1 | ✓ | | | | ✓ | | | | |
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| Agricultural research, research ethics and rural development programmes | PGS-505 | CO1 | ✓ | ✓ | | | ✓ | | | ✓ | |
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| Disaster management | PGS-506 | CO1 | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ |
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| Physiological and molecular responses of plants to abiotic stresses | PP 503 | CO1 | ✓ | | | | ✓ | | | | |
| | | CO2 | | ✓ | | | | ✓ | | ✓ | |

| **Mapping of COs vs. Employability/ Entrepreneurship/ Skill development** | | | | |
|---|---|---|---|---|
| **Name of the Course** | **Course Code** | **Employability** | **Entrepreneurship** | **Skill development** |
| Horticultural Plant Propagation and Nursery Management | Hort-501 | Y | Y | Y |
| Principles and Production of Vegetables Crops | Hort-502 | Y | Y | Y |
| Principles of Landscaping and Production Technology of Ornamental Plants | Hort-503 | Y | Y | Y |
| Horticultural Biotechnology | Hort-504 | Y | Y | Y |
| Nutrition of Horticultural Crops | Hort-505 | Y | | Y |

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|---|---|---|---|---|
| Growth and Development of Horticultural Crops | Hort-506 | Y | | Y |
| Principles and Production of Fruit Crops | Hort-507 | | Y | Y |
| Principles of Post- harvest Management and Processing of Horticultural Crops | Hort-508 | Y | Y | Y |
| Breeding of Vegetable and Ornamental Crops | Hort-509 | | Y | Y |
| Fruit and Plantation Crop Breeding | Hort-510 | Y | Y | Y |
| Medicinal, Aromatic, Plantation Crops and Spices Production | Hort-511 | Y | Y | Y |
| Vegetable and Flower Seed Production Technology | Hort-512 | | Y | Y |
| Laboratory Techniques and Research Methodology in Post-harvest Technology | Hort-513 | Y | | Y |
| Protected Cultivation of Vegetables | Hort-514 | Y | Y | Y |
| Commercial Floriculture | Hort-515 | Y | Y | Y |
| Orchard Management | Hort-516 | Y | Y | Y |
| Master's Research | Hort-599 | | | Y |
| Seminar | Hort-591 | Y | | Y |
| Master's Research | Hort- 599 | | | Y |
| Biological control of crop pest and weeds | EN-507 | Y | Y | Y |
| Hormonal regulation of plant growth and development | PP-504 | Y | | Y |
| Physiological and molecular responses plant to abiotic stress | PP-505 | | | Y |
| Principle of plant breeding | PBG-503 | Y | Y | Y |
| Mineral nutrition | PP-510 | | | Y |
| Biotechnology for crop improvement | PBG-511 | Y | | Y |
| Post Harvest diseases | Pl. Patho-517 | Y | | Y |
| Experimental design | Stat-570 | Y | Y | Y |
| Library and Information Services | PGS 501 | Y | | Y |
| Technical Writing and Communications Skills | PGS 502 | Y | | Y |
| Intellectual Property and Its Management in Agriculture | PGS 503 | Y | Y | Y |
| Basic Concepts In Laboratory Techniques | PGS 504 | Y | Y | Y |
| Agricultural Research, Research Ethics and Rural Development Programmers | PGS 505 | Y | Y | Y |