# Shri Vishwanath P. G. College Kalan, Sultanpur

*(Affiliated)*

**DR. RAM MANOHAR LOHIA AVADH UNIVERSITY, AYODHYA**

Structure of Syllabus for the Program: M.Sc.(Ag.)

**Subject: Horticulture**

| SEMESTER-WISE TITLES OF THE PAPERS IN M. Sc. (Ag.) COURSES | | | | | |
|---|---|---|---|---|---|
| **YEAR** | **SEME-STER** | **COURSE CODE** | **PAPER TITLE** | **THEORY/ PRACTICAL** | **CREDIT** |
| ***DEGREE*** **IN MASTER OF SCIENCE IN AGRICULTURE (HORTICULTURE)** | | | | | |
| **FIRST YEAR** | **I** | HORT-501 | Propagation and Nursery Management For Fruit Crops | Theory and Practical | 3(2+1) |
| | | HORT-502 | Landscaping and Ornamental Gardening | Theory and Practical | 3(2+1) |
| | | HORT-503 | Tropical and Dry Land Fruit Production | Theory and Practical | 3(2+1) |
| | | AS-501 | Agricultural Statistics | Theory and Practical | 3(2+1) |
| | **II** | HORT-504 | Production Technology of Cool Season Vegetable Crops | Theory and Practical | 3(2+1) |
| | | HORT-505 | Subtropical and Temperate Fruit Production | Theory and Practical | 3(2+1) |
| | | HORT-506 | Production Technology of Cut and Loose Flowers | Theory and Practical | 3(2+1) |
| | | HORT-507 | Protected Cultivation of Horticultural Crops | Theory and Practical | 2(1+1) |

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| **SECOND YEAR** | **III** | HORT-508 | Production Technology of Warm Season Vegetable Crops | Theory and Practical | 3(2+1) |
| | | HORT-509 | Breeding of Horticultural Crops | Theory and Practical | 3(2+1) |
| | | HORT-510 | Post -Harvest Technology of Horticultural Crops | Theory and Practical | 3(2+1) |
| | | CA-502 | Computer Application in Agriculture | Theory and Practical | 2(1+1) |
| | **IV** | HORT-591 | Master Seminar | Presentation | 1(0+1) |
| | | HORT-599 | Master Research (Thesis) | Research | 20 |
| **OR** | | | | | |
| **Special papers (20 credits) satisfactory/unsatisfactory** | | | | | |
| | | HORT-511 | Fruit Technology | Theory and Practical | 4(3+1) |
| | | HORT-512 | Production Technology of Medicinal and Aromatic Crops | Theory and Practical | 4(3+1) |
| | | HORT-513 | Production Technology of Plantation & Spices Crops | Theory and Practical | 4(3+1) |
| | | HORT-514 | Advance Horticulture | Theory and Practical | 4(3+1) |
| | | HORT-515 | Production Technology of under -utilize Sub-tropical Crops | Theory and Practical | 4(3+1) |

# Semester I

**HORT 501- [ Propagation and Nursery Management For Fruit Crops] 3(2+1)**

**Theory:**

**UNIT I:** Introduction, life cycles in plants, cellular basis for propagation, sexual propagation, apomixes, Polyembryony, chimeras: Principle factors Influencing send germination of horticultural crop, dormancy, hormonal regulation of germination and seedling growth.

**UNIT II:** Seed quality, treatment packing, storage, certification, testing Asexual propagation-rooting of soft and hard wood cutting under mist by growth regulators Rooting of cuttings in hotbeds. Physiological, anatomical and biochemical aspects of root induction to cuttings Layering-principles and methods.

**UNIT III:** Budding and grafting-selections of elite mother plants, methods Establishment of bud wood bank, stock, scion and inter rock relationship- incompatibility. Rejuvenation through top working - Progeny orchard and scion bank.

**UNIT IV:** Micro-propagation-principles and concepts, commercial exploitation in horticultural crops. Techniques in via clonal propagation, direct organogenesis, embryogenesis, micrografting, meristem culture. Hardening, packing and transport of micro-propagules.

**UNIT V:** Nursery types, structures, components, planning and layout Nursery management practices for healthy propagules production.

**Practical:** Anatomical studies in rooting of cutting and graft union; construction of propagation structures, study of medias and PGR. Hardening-case studies micro propagation, explant preparation, media preparation, culturing - in vitro clonal propagation, meristem culture, shoot tip culture, axillary bud Culture, direct organogenesis, direct and indirect embryogenesis, micro- grafting, hardening, Visit to TC labs and nurseries.

**HORT-502: [Landscaping and Ornamental Gardening] 3(2+1)**

**Theory:**

**UNIT I:** Landscape designs, types of gardens, English, Mughal, Japanese. Persian, Spanish, Italian, Vanams, Buddha garden; Styles of garden, formal, informal and free style gardens.

**UNIT II:** Urban landscaping. Landscaping for specific situations, institutions. industries, residents, hospitals, roadsides, traffic islands, dam sites, IT parks, Corporates

**UNIT III:** Garden plant components, arboretum, shrubbery, Fernery, palmatum, arches and pergolas, edges and ledges, climbers and creepers, cacti and succulents, herbs, annuals, flower borders and beds, ground covers, carpet beds, bamboo groves; Production technology for selected ornamental plants.

**UNIT IV:** Lawns, establishment and maintenance, special types of gardens, vertical garden, roof garden, bog garden, sunken garden, rock garden, clock garden, colour wheels, temple garden, sacred groves.

**UNIT V:** Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.

**Practical:** Selection of ornamental plants, practices in preparing designs for home gardens, industrial gardens Institutional gardens corporates, avenue planting. Practices in planning and planting of special types of gardens, burlapping. Lawn making, planting herbaceous and shrubbery borders, project preparation on landscaping for different situations, visit to parks and botanical gardens, case study on commercial landscape gardens.

**HORT-503-: [Tropical and Dry Land Fruit Production] 3(2+1)**

**Theory:** Commercial varieties of regional, national and internationals importance. Eco physiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zones and canopy management, nutrient management, water management, fertigation, role of bio regulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, pest and diseases management physiological disorders-causes and remedies, quality improvement by management practices, maturity indices, harvesting. Industrial and export potential. Agri. Export Zones (AEZ) and industrial supports.

**UNIT I:** Mango and Banana
**UNIT II:** Citrus and Papaya
**UNIT III:** Guava, Sapota and Jackfruit
**UNIT IV:** Pineapple, Annonas and Avocado
**UNIT V:** Aonla, Pomegranate, Phalsa and Ber, minor fruits of tropics
**Practical:** Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analysis of quality attributes, visit to tropical and arid zone orchards, project preparation for establishing commercial orchards.

**AS 501: [Agricultural Statistics] 3(2+1)**

**Theory:**

**UNIT I:** Classification, tabulation and graphical representation of data. Box-plot. Descriptive statistics. Exploratory data analysis; Theory of probability. Random variable and mathematical expectation.

**UNIT II:** Discrete and continuous probability distribution: Binomial, Poisson, Normal distribution, Concept of sampling distribution chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distribution. Large sample theory.

**UNIT III:** Introduction to theory of estimation and confidence-intervals, correlation and regression, Simple and multiple linear regression model, estimation of parameters, predicted value and residuals, correlation coefficient, partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient, test of significance of correlation coefficient and regression coefficient, coefficient of determination.

**UNIT IV:** Need for designing of experiments, characteristics of a good design, Basic principles of designs, randomization, replication and local control.

**UNIT V:** Uniformity trails, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing plot techniques, split plot design.

**UNIT VI:** Sampling Techniques - Planning of survey, method of data collection, questionnaire v/s schedule, Problems of sampling frame choice of sample of design, probability sampling, sample space, sampling design, simple random sampling, Estimation of proportion, confidence interval, Determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation, Non sampling error-source and classification.

**Practical:** Related with the course.

# Semester II

**HORT-504: [Production Technology of Cool Season Vegetable Crops] 3(2+1)**

**Theory:**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate end seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post- harvest management, plant protection measures and seed production of:

**UNIT I:** Potato

**UNIT II:** Cole crops- Cabbage, Cauliflower, Knol kohl, Sprouting broccoli, Brussels sprout

**UNIT III:** Root crops- Carrot, Radish, Turnip and Beetroot

**UNIT IV:** Bulb crops- Onion and Garlic.

**UNIT V:** Peas and Broad bean, green leafy cool season vegetables

**Practical:** Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of winter vegetable crops and their economic; Experiments to demonstrate the role of mineral elements, plant growth substances end herbicides; study of physiological disorders; preparation of cropping scheme for commercial farms; visit to commercial greenhouse/polyhouse.

**HORT-505: [Subtropical and Temperate Fruit Production] 3(2+1)**

**Theory:**

Commercial varieties of regional, national and international importance. Eco physiological requirements, recent trends in propagation, rootstock influence, planting systems cropping systems, root zone and canopy management, nutrient management, water management, fertigation bio regulation, abiotic factors, limiting fruit production, physiology of flowering, fruit set and development abiotic factors limiting production. Physiological disorder-causes and remedies, quality improvement by management practices; maturity indices, harvesting, industrial and export potential, Agri Export Zone (AEZ) and industrial support.

**UNIT I:** Apple, pear, quince, grapes

**UNIT II:** Plums, peach, apricot, cherries, hazelnut

**UNIT III:** Litchi, loquat, persimmon, kiwifruit, strawberry

**UNIT IV:** Nuts-walnut, almond, pistachio, pecanut

**UNIT V:** Minor fruits-mangosteen, carambola, bael, wood apple, fig, jamun, rambutan, pomegranate

**Practical:** Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical subtropical, humid, tropical and temperate orchards, Project preparation for establishing commercial orchards.

**HORT-506: [Production Technology of Cut and Loose Flowers] 3(2+1)**

**Theory:**

**UNIT I:** Scope of cut and loose flowers in global trade, Global Scenario of cut and loose flower production. Varietal wealth and diversity, area under cut and loose flowers and production problems in India-Patent rights, nursery management, media for nursery, special nursery practices.

**UNIT II:** Growing environment, open cultivation of cut and loose flower, soil requirements, field preparation, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and $CO_2$, on growth and flowering.

**UNIT III:** Flower production - water and nutrient management, fertigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

**UNIT IV:** Flower forcing and year round flowering through physiological interventions, chemical regulation, environmental manipulation.

**UNIT V:** Cut flower standards and grades, harvest indices, harvesting techniques. Post- harvest handling. Methods of delaying flower opening, prolonging self life, Pre-cooling pulsing packing Storage & transportation, marketing, export potential, institutional support. Agri Export Zones.Crops: Rose, chrysanthemum, carnation, gerbera, gladioli tuberose, orchids, anthurium, aster, liliums, as cut flower nyctanthes, jaismine, marigold, crosandra, celosia, amplirena as loose flower.

**Practical:** Botanical description of varieties, propagation techniques, mix chamber operation, training and pruning techniques, practices in manuring, drip and fertigation, foliar nutrition, growth regulator application, pinching, disbudding, staking, harvesting techniques, post-harvest handling, cold chain, project preparation for regionally important cut and loose flowers, visit to commercial flower units and case study.

**HORT-507: [Protected Cultivation of Horticultural Crops] 2(1+1)**

**Theory:**

**UNIT I:** Importance and scope of protected cultivation, world scenario, Indian situation, present and future scope. Principles used in protected cultivation, energy management, low cost structures.

**UNIT II:** Regulatory structures used in protected structure, types of greenhouse/polyhouse/net house, hot beds, cold frames, effect of environmental factors viz temperature, light. $CO_2$ and humidity on growth of different vegetables, flowers and fruits, manipulation of $CO_2$ light and humidity and temperature for production of horticultural crops, installation of micro irrigation and fertilization.

**UNIT III:** Nursery raising in protected structures like poly-tunnels, types of benches and containers, different media for growing nursery under cover.

**UNIT IV:** Regulation of flowering and fruiting in horticultural crops, technology for raising tomato, sweet pepper, cucumber crops. Gerbera, chrysanthemum and straw berry in protected structures, training and staking in protected crops, varieties and hybrids suitable for growing in protected structures.

**Unit V:** Problems of growing horticultural crops in protected structures and their remedies. Insect and disease management in protected structures.

**Practical:** Study of various types of structures, methods to control temperature, CO, and light, media, training and pruning, fertigation and nutrient management, control of insect-pests and disease in greenhouse; economics of protected cultivation, visit to established green/polyhouse/net house/shade house in the region.

# Semester III

**HORT-508: [Production Technology of Warm Season Vegetable Crops] 3(2+1)**

**Theory:** Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutrition and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures, economies of crop production and seed production of:

**UNIT I:** Okra, Cowpea and Cluster bean

**UNIT II:** Cucurbitaceous crops like Musk Melon, Cucumber and Bitter gourd

**UNIT III:** Sweet Potato

**UNIT IV:** Green leafy warm season vegetables like Spinach and Amaranthus

**Practical:** Cultural operations (fertilizer application, sowing, mulching irrigation, weed control) of summer vegetable crops and their economies, study of physiological disorders and deficiency of mineral elements, preparation of cropping schemes for commercial farms, experiments to demonstrate the role of mineral elements, physiological disorders. plant growth substances and herbicides; seed extraction techniques, identification of important pests and diseases and their control; maturity standards, economics of warm season vegetable crops.

**HORT 509: [Breeding of Horticultural Crops] 3(2+1)**

**Theory:** Origin, botany, taxonomy, genetics, breeding objectives, breeding methods (introduction, selection and hybridization) varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, issue of patenting, PPVFR act, achievement and future trust in following selected crops.

**UNIT I:** Tomato, Brinjal and Chilli

**UNIT II:** Okra and Pumpkin

**UNIT III:** Cabbage, Cauliflower, Carrot, Turnip and Radish

**Practical:** Selection of desirable Plants from breeding population, observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generation: induction of flowering, falynological studies, selfing and crossing techniques in horticulture crops, hybrid seed production of vegetable crops in bulk, screening techniques for insect. pests, disease and environmental stress resistance in above mentioned crops, demonstration of sib-mating and mixed population, visit to breeding blocks.

**HORT 510: [Post Harvest Technology of Horticultural Crops] 3(2+1)**

**Theory:**

**UNIT I:** Maturity indices, harvesting practices for specific market requirements, influence of pre- harvest practices, enzymatic and textural changes, respiration and transpiration.

**UNIT II:** Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management factors leading to post harvest losses horticultural crops pre-cooling Spoilage, microbial and biochemical, physical injuries and disorders.

**UNIT III:** Temperature prior to transportation, viz grading, precooling, chlorination, waxing, chemicals, bio control agent and natural plant products. Methods of storage- ventilated, refrigerated, MAS, CA storage, Zero energy cool chamber and hypobaric storage.

**UNIT IV:** Packaging method and transport, principles and methods of preservation food processing, canning preparation of fruits juices, beverages, pickles, jam, jellies, candies and tomato products.

**UNIT V:** Dried and dehydrated products, nutritionally enriched products, fermented beverages, packaging technology, management of processing waste, food safety standards.

**Practical:** Analyzing maturity stages of commercially important horticultural crops, improved packaging and storage of important horticultural commodities, physiological loss in weight of fruits and vegetables, estimation of transpiration, respiration rate. Ethylene release and study of vase life extension in cut flowers using chemicals, estimation of quality characteristics in stored fruits and vegetables, cold chain management, visit to cold storage and CA storage units, visit to fruit and vegetable processing units, project preparation, evaluation of processed horticultural products.

**CA 502- [Computer Application in Agriculture] 2(1+1)**

**Theory:** Introduction to computer, operating system, definition and types, application of Ms-Office for document creation & editing, data presentation, interpretation and graph creation, statistical analysis, mathematical expression, database concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW); Memory, Basic Anatomy of Computer System. e-Agriculture concepts and applications. Use of ICT in Agriculture. IT application for computation water and nutrient requirement of crops, computer-controlled devices (automated systems) for agri-input management, Smart phone Apps in Agriculture. Decision support systems, concepts, components and applications in agriculture.

**Practical:** Study of computer components, accessories, practice of important DOS Commands, introduction of different operating system such as window, files & folders, File Management. Use of MS- Word and MS Power point for creating, editing and presenting a scientific document. MS-Excel - Creating a spread sheet, use for statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-Access Creating database.

# Semester IV

**HORT 591: Master Seminar** **1 (0+1)**
Presentation on relevant topic of concerned discipline

**HORT 599: Master Research (Thesis)** **20 (0+20)**
Perform research work and thesis writing on topic or title related to discipline of Horticulture.

**HORT 511: [Fruit Technology (Special Paper) ]** **4(3+1)**

**Theory:**

**UNIT I:** History, present position and future scope of fruit and vegetables preservation industries in India. General principles of fruit and vegetables preservation.

**UNIT II:** Canning and bolting of fruit vegetables, brief history of scientific canning, equipment for home canning and commercial production, important consideration for laying out of canning. Canning of important fruits, vegetables, spoilage in canned fruits and vegetables.

**UNIT III:** Fruits and vegetables juices, unfermented beverages (sweetened and unsweetened), principles of preservation, home and commercial scale equipment for juices, preparation and preservation of juices, squashes and cardials from Citrus fruits. Mango, Phalsa, Jamun, Grape, Pomegranate Tomato etc Fruit juice concentrates and their general method of preparation

**UNIT IV:** Jams, Jellies and Marmalades, role of pectin-sugar and acid in jelly formation. general method of preparation of jams, jellies and marmalades, use of jelly meter etc. Equipment for home and commercial production.

**UNIT V:** Pickles, sauces, chutney and vinegar, Potato chips general principles, equipment and method of preparation, preserve, candy and canes fruits, general principles and method of preparation of by product from fruit and vegetables waste in home and commercial production and sun drying and dehydration of fruit and veg etables, equipment and methods.

**Practical:**

1- List of important equipments for fruit and vegetable preservation.
2- Preparation of Jam, Jelly, Marmalade and Pickles (Mango, Lime and Mix Veg).
3- Preparation of Beverages (RTS, Squash, Nectar, Syrup and Barley Water).
4- Preparation of preserve and candy (Aonla, Bael and Karaunda).
5- Preparation of Tomato products (Sauce, Ketchup and Chutney).
6- Preparation of Potato Chips and canning of Pea.

**HORT 512: [Production Technology of Medicinal and Aromatic Crops (Special Paper) ]** **4(3+1)**

**Theory:**

**UNIT I:** Importance and scope of medicinal and aromatic crops in India and future prospects, classification of medicinal and aromatic crops.

**UNIT II:** Cultivation of medicinal crops like Rauvolfia, Andrographis, Aloe- vera, Safed musli, Isabgol, Ashwagnadha, Bacopa and Asparagus.

**UNIT III:** Cultivation of aromatic crops like Mentha, Java citronella, Khus, Ocimum, Chamomile, Lemon grass, Geranium, Palmarosa and Rose.

**UNIT IV:** Special problems of medicinal and aromatic crops and their control.

**UNIT V:** Different method of distillation of medicinal and aromatic crops, problems of distillation and their solution. Marketing of medicinal and aromatic crops.

**Practical: 1-** Identification of medicinal and aromatic crops.

2- Study of propagation techniques of medicinal and aromatic crops.

3- Study of cost of production of Rauvolfia, Aloevera, Safed musli, Mentha, Turmeric and Ginger.

4- Study of different methods of distillation of medicinal aromatic plants.

5- Visit of distillation plants and institute related to medicinal and aromatic crops.

**HORT 513: [Production Technology of Plantation and Spices Crops (Special Paper) ] 4(3+1)**

**Theory:**

**UNIT I;** Importance and scope of plantation and spices crop in India, its area and distribution.

**UNIT II:** Production technology of plantation crops like, coconut, areca nut, cashew nut. tea, cocoa and coffee.

**UNIT III:** Production technology of spices crops like, Turmeric, Zinger Cumin, Coriander, Fennel, Blackpeper, Cardamom (Large and small).

**UNIT IV:** Problems of plantation and spices crops and their remedies. Marketing, post- harvest management and storage of plantation and spices crops.

**UNIT V:** Problems of plantation and spices crops and their remedies, marketing, post- harvest management and their storage of plantation and spice crops.

**Practical:**

1- Identification of plantation and spice crops.

2- Propagation method of plantation crops.

3- Preparation of nursery for plantation.

4- Calculation of cost of production per hectare of spices crops, Turmeric, Zinger, Coriander and Cumin.

**HORT 514- [Advance Horticulture (Special Paper) ] 4(3+1)**

**Theory:**

**UNIT I:** Introduction and important mechanization of nursery, micro propagation of horticultural crops. Advantage and limitations, types of culture (Seed, Embryo, organ, callus and cell).

**UNIT II:** Advance made in root stocks, development of root stocks for biotic and abiotic stress.

**UNIT III:** Advances in irrigation system, advantage and disadvantage of drip irrigation, sprinkler and rain gun.

**UNIT** Canopy management of tropical and subtropical fruit crops like Mango, Guava, Grapes, Ber and Bael.

**UNIT V** Special problems of fruit crops and their control (Mango Guava, Papaya, Grapes, Pine apple and Apple), High density orcharding in fruits crops.

**Practical:**

1- Identification and use of equipment's in tissue culture laboratory.
2- Sterilization technique of media.
3- Identification and application of tools and equipment related to micro-irrigation system and canopy management.
4- Identification of special problems of fruit crops.

**HORT 515: [Production technology of under utilze Sub-tropical fruits (Special Paper) ] 4(3+1)**

**Theory:**

**UNIT I;** Importance and scope of under utilize fruits in India. Distribution and description of under utilize fruits.

**UNIT II:** Production techniques of under utilize fruits subtropical fruits like Bael, Custard apple, Wood apple, Barbados cherry, Citrus, Grapes, Litchi, Ber, Loquat, Phalsa, Fig, Mulberry, Karonda and Aonla.

**UNIT III:** Propagation technique of under utilize fruits, sexual and asexual including micro-propagation.

**UNITIV:** Problem of under utilize fruits and then remedies.

**UNIT V:** Marketing Post harvest management and storage of under utilize fruits.

**Practical:**

1- Identification of under utilize fruits
2- Propagation of under utilize fruits
3- Filling and lifting of polybags.
4- Packaging and sapling.
5- Visit of research centres working on under utilize fruits