SRI DEV SUMAN UNIVERSITY

BADSHAHITHAUL (TEHRI GARHWAL)

Syllabus

DEPARTMENT OF HORTICULTURE

Course Curriculum for M. Sc. Horticulture/M. Sc. (Ag.) Horticulture, 2014-15

M.Sc. (Horticulture)

COURSE STRUCTURE – AT A GLANCE

FIRST SEMESTER M.M.: 600

SDMHC 101	Systematic Horticulture
SOMHC 102	Plant Propagation and Nursery Management
SOMAHC 103	Statistical Methods and Experimental Designs
SOMHC 104	Advances in Pomology : Tropical and Subtropical Fruits
SOMHC 105	Practical I
SOMAHC 106	Practical II

M.Sc. (Horticulture)

COURSE STRUCTURE – AT A GLANCE

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SECOND SEMESTER M.M.: 600

SDMHC 201	Advances in Temperate- Zone Pomology
SDMHC 202	Advances in Olericulture
SDMHC 203	Canopy Management in Fruits Crops
SDMHC 204	Biotechnology of Horticultural Crops
SDMHC 205	Practical I
SDMHC 206	Practical II

SRI DEV SUMAN UNIVERSITY BADSHAHITHAUL (TEHRI GARHWAL)

M.Sc. (Horticulture)

COURSE STRUCTURE – AT A GLANCE

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THIRD SEMESTER M.M.: 600

SDMHC 301	Advances in Post- Harvest Technology and Management of Fruits and Vegetables
SDMHC 302	Protected Cultivation of Horticultural Crops
SDMHC 303	Advances in Floriculture and Landscaping
SDMHC 304	Advances in Orchard Management
SDMHC 305	Practical I
SDMHC 306	Practical II

SRI DEV SUMAN UNIVERSITY BADSHAHITHAUL (TEHRI GARHWAL)

M.Sc. (Horticulture)

COURSE STRUCTURE – AT A GLANCE

FOURTH SEMESTER M.M.: 600

SDMHC 401	Biotic and Abiotic Stress Management in Horticultural Crops
SDMHC 402	Organic Horticulture
SOAHE 506	Practical I
	Seminar
	Thesis

SRI DEV SUMAN UNIVERSITY BADSHAHITHAUL (TEHRI GARHWAL)

M.Sc. (Horticulture)

COURSE STRUCTURE – AT A GLANCE

PROPOSED REGULATIONS

Semesters/Papers Title of the papers

SEMESTER I

Sn.No	Subject Name	Subject Code No	Total Marks	Theory Marks	*Internal Marks*	Mini. Passing marks	Credit
1	Systematic Horticulture	SDMHC Paper 101	100	**60**	**40**	**40**	**3**
2	Plant Propagation and Nursery Management	SDMHC Paper 102	100	**60**	**40**	**40**	**3**
3	Statistical Methods and Experimental Designs	SDMHC Paper 103	100	**60**	**40**	**40**	**3**
4	Biotechnology of Horticultural Crops	SDMHC Paper 104	100	**60**	**40**	**40**	**3**
5	PRACTICAL I	SDMHC Paper 105	100	**60**	**40**	**40**	**2**
6	PRACTICAL II	SDMHC Paper 106	100	**60**	**40**	**40**	**2**

Total aggregate of First Semester is 45% Max. Marks – 600, Min.Marks – 250

M.Sc. (Horticulture)

COURSE STRUCTURE – AT A GLANCE

PROPOSED REGULATIONS

Semesters/Papers Title of the papers

SEMESTER II

Sn.No	Subject Name	Subject Code No	Total Marks	Theory Marks	*Internal Marks*	Mini. Passing marks	Credit
1	Advances in Temperate-Zone Pomology	SDMHC Paper 201	100	**60**	**40**	**40**	**3**
2	Advances in Olericulture	SDMHC Paper 202	100	**60**	**40**	**40**	**3**
3	Canopy Management in Fruits Crops	SDMHC Paper 203	100	**60**	**40**	**40**	**3**
4	Biotechnology of Horticultural Crops	SDMHC Paper 204	100	**60**	**40**	**40**	**3**
5	PRACTICAL I	SDMHC Paper 205	100	**60**	**40**	**40**	**2**
6	PRACTICAL II	SDMHC Paper 206	100	**60**	**40**	**40**	**2**

Total aggregate of First Semester is 45% Max. Marks – 600, Min.Marks – 250

M.Sc. (Horticulture)

COURSE STRUCTURE – AT A GLANCE

PROPOSED REGULATIONS

Semesters/Papers Title of the papers

SEMESTER III

Sn.No	Subject Name	Subject Code No	Total Marks	Theory Marks	*Internal Marks*	Mini. Passing marks	Credit
1	Advances in Post-Harvest Technology and Management of Fruits and Vegetables	SDMHC Paper 301	100	60	40	40	3
2	Protected Cultivation of Horticultural Crops	SDMHC Paper 302	100	60	40	40	3
3	Advances in Floriculture and Landscaping	SDMHC Paper 303	100	60	40	40	3
4	Advances in Orchard Management	SDMHC Paper 304	100	60	40	40	3
5	PRACTICAL I	SDMHC Paper 305	100	60	40	40	2
6	PRACTICAL II	SDMHC Paper 306	100	60	40	40	2

Total aggregate of First Semester is 45% Max. Marks – 600, Min.Marks – 250

M.Sc. (Horticulture)

COURSE STRUCTURE – AT A GLANCE

PROPOSED REGULATIONS

Semesters/Papers Title of the papers

SEMESTER IV

Sn.No	Subject Name	Subject Code No	Total Marks	Theory Marks	*Internal Marks*	Mini. Passing marks	Credit
1	Biotic and Abiotic Stress Management in Horticultural Crops	SDMHC Paper 401	100	**60**	**40**	**40**	**3**
2	Organic Horticulture	SDMHC Paper 402	100	**60**	**40**	**40**	**3**
3	SEMINAR	SDMHC Paper 403	100	**60**	**40**	**40**	**3**
4	THESIS (THESIS & VIVA – VOCE FARMING	SDMHC Paper 404	200	**130+50**	**20**		**2**
5	PRACTICAL	SDMHC Paper 405	100	**60**	**40**	**40**	**2**

Total aggregate of First Semester is 45% Max. Marks – 600, Min.Marks – 250

Syllabus for M.Sc. Horticulture/ M.Sc.(Ag.) Horticulture 2014-15
First Semester

SDMHC 101: Systematic Horticulture

Introduction, importance and scope, botanical terminology. Plant classification history and systems- artificial, natural and modern systems. Nomenclature: importance, bino.mial classification and its salient.features. Morphological description of (vegetative, floral and fruit features) of the following important families of fruits, vegetables and ornamental crops:-

Anacardiaceae - Mango, Cashewnut; Rutaceae- Citrus, . Murrayas, Kamini; Musaceae- Banana; Myrtaceae- Guava, Bottle brush, Rosaceae- Apple, Pear, Plum, Peach, Apricot, Loquat, Rose; Apocyanaceae- Karonda, Kaner, Chandini; Vitaceae- Grapes; Sepindaceae- Litchi; Caricaceae- Papaya; Brassicaceae- cauliflower, cabbage, Radish, Turnip; Cucurbitaceae- Cucurbits; Solanaceae- Brinjal,Tomato, Chillies, Potato, Rat-ki-rani; Leguminaceae- Peas, Beans, Kachnar, Ashok, Cassia; Malvaceae- Bhindi, Hibiscus; Euphorbiaceae- Achalipha, Poinsettia, Croton; Nyctaginaeceae-Bougainvillea; Rubiaceae- Hamelia, Mussanda, Ixoraparviflora; Ramnaceae- Ber; Amaryllidaceae- Onion, Garlic.

Practicals- Identification and botanical description (vegetative and floral features) of available fruits, vegetables and ornamental plants.

SDMHC 102: **Plant Propagation and Nursery Management**

Introduction, life cycle in plants,cellular basis for propagation, apomixis, polyembrony, germination process and environmental factors affecting it, quality of seeds, seed dormancy, treatments to facilitate germination, seed testing, diseases control during germination.Clone and phase variation, genetic variation in asexually propagated plants, producton and maintenance of pathogen free clones, cutting- anatomical, physiological and biochemical aspects of root initiation in cuttings, types of cuttings, use of bioregulators, mist systems of rooting cuttings, planting and care, layering- principles and methods.Reasons for grafting and budding, categories of root-stock, formation of graft and bud union, factors influencing the healing of graft union, limits of grafting, graft incompatibility, scion-stock relationship, techniques of grafting, budding and layering.

Micro propagation: Introduction, objectives, merits and demerits, facilities and equipments, aseptic techniques and use of antibiotics, media preparation, micro propagation techniques- clonal propagation, direct orgamagenesis, embryogenesis, meristem culture culture, micro grafting, hardening, packing and transport of micropropagules.Nursery Management: types of nursery, location, components planning and layout of a commercial nursery,structures, media mixtures, nursery management practices

Practicals- Practice of grafting, budding, cutting and layering, anatomical studies ofrooting of cuttings and grafting union, planning and layout for commercial nursery, sample seed testing, use of bioregulators in propagation, sterilization of equipments and laboratory, media preparation, selection and preparation of explants, meristem culture and micro grafting, planning and layout of experiments on various aspects of propagation. Visit to tissue culture labs and nurseries.

SDMHC 103: Statistical Methods and Experimental Designs

Sampling theory- introduction, simple random sampling, estimates of sampling variance, stratified random sampling, two stage sampling, systematic sampling, estimate of proportions.

Test of hypothesis- introduction, one sample t-test and two sample t- test. Chisquare test-properties, testing significance of properties, testing independence of tributes Bartlett test, (F-Test).Correlation- coefficient of correlation, test of significant, Fisher's Z- transformation, rank correlation, intraclass correlation. Regression- regression curve, fitting of line regression.Need for an experiments, designing of an experiment, experimental error, principles of experimental design, analysis of designed experiments- analysis of variance, mathematical details, assumptions, transformation and anova table, pairwise comparisons and specific comparisons of treatments.

Completely randomized design- layout, application, merits and demerits, analysis of equal and unequal observations. Randomized block design- layout, application, merits and demerits, analysis, efficiency of blocking. Latin square design- layout, application, merits and demerits, analysis, change over design. Analysis of covariance for reduction of experimental error in CRD, RBD and L. S. designs. Split plot and related designs layout, application, merits and demerits, analysis, efficiency, variants of split plot design, strip plot design. Factorial experiments- concept of factorial treatments, definition of main effects and interrelations, analysis of series using Yates method.

Practicals- Practicals based on above topics.

SDMHC 104: Advances in Pomology: Tropical and Subtropical Fruits Introduction, prospects and scope, constraints of fruit industry. Origin and distribution, area and production, taxonomy, classification and description of important cultivars, nutrition, bearing habit, pollination and fruit set, use of bioregulators, special problems and physiological disorders in the production of the following fruits:Tropical and subtropical fruits- Mango, Citrus fruits, Banana, Guava, Grape, Litchi, Papaya, Pine-apple, Jack-fruit.Minor fruits- Ber, Aonla, Pomegranate, Loquat, Sapota, Phalsa, Bael, Karonda,

Practicals- Identification and morphological features of important cultivars of fruit, effect of bioregulators, practice of commercial propagation techniques, moisture conservation techniques, pollen germination, study of mango malformation, guava wilt, citrus decline, blossom biological studies, visit to Fruit Research Centres.

Second Semester

SDMHC 201: Advances in Temperate-Zone Pomology

Introduction, scope, area and production, temperate regions, contour planting, rest period and chilling requirement. Origin and distribution, area and production, taxonomy, classification and description of important cultivars, clonal rootstocks, training techniques, bearing habit, pollination and fruit set, use of bio-regulators, special problems and physiological disorders of the following fruits: ***Pome Fruits***- Apple and Pear,***Stone Fruits***- Peach, Plum, Apricot, Cherry and Almond,***Nut Fruits***- Walnut, Pecannut, Hazelnut and Pistachio etc. ***Berries***- Strawberry, Raspberry, Gooseberry,Kiwi fruit. Exposure to wild fruits of Uttarakhand hills.

Practicals- Identification and morphological features of temperate fruits, practice of contour planting, commercial propagation methods, pollen collection and germination, pruning and training, use of bioregulators, visit to Temperate Fruit Research Stations.

SDMHC202: Advances in Olericulture

Introduction, types of vegetable farming, vegetable forcing, bioregulators in vegetable production, principles of vegetable seed production. Origin and distribution, area and production, taxonomy, classification and description of cultivars, use of bioregulators, seed production, specific problems and physiological disorders of the following vegetables: ***Solanaceous Vegetables***- Potato, Tomato, Brinjal, Chilli, Capsicum, ***Root Vegetables***- Radish, Turnip, Carrot, ***Cole Vegetables***- Cauliflower, Cabbage, Knol-khol, ***Legume Vegetables***- Peas and French bean, ***Bulb Vegetables***- Onion, Garlic, ***Cucurbits***- Cucumber, Water melon, Bottle gourd, Sponge gourd, Musk melon, Pumpkin, ***Leafy Vegetables***- Spinach, Amaranthus, Okra and Sweet Potato

Practicals- Identification and morphological features of vegetables, seed production techniques, study of disorders, use of bioregulators, basal and foliar application of nutrients, cost of vegetable cultivation, experimental trials, visit to vegetable seed production centres and processing units.

SDMHC 203: Canopy Management in Fruits Crops

Canopy management - importance and advantages; factors affecting canopy development. Canopy types and structures with special emphasis on geometry of planting, canopy manipulation for optimum utilization of light. Light interception and distribution in different types of tree canopies. Spacing and utilization of land area - Canopy classification; Canopy management

through rootstock and scion. Canopy management through plant growth inhibitors, training and pruning and management practices. Canopy development and management in relation to growth, flowering, fruiting and fruit quality in temperate fruits, grapes, passion fruits, mango, sapota, guava, citrus and ber.

Practicals-Study of different types of canopies, training of plants for different canopy types, canopy development through pruning, use of plant growth inhibitors, geometry of planting; study on effect of different canopy types on production and quality of fruits.

SDMHC 204: Biotechnology of Horticultural Crops

Harnessing bio-technology in horticultural crops, influence of plant materials, physical, chemical factors and growth regulators on growth and development of plant cell, tissue and organ culture.

Callus culture – types, cell division, differentiation, morphogenesis, organogenesis, embryogenesis.

Use of bioreactors and in vitro methods for production of secondary metabolites, suspension culture, nutrition of tissues and cells, regeneration of tissues, ex vitro, establishment of tissue cultured plants.Physiology of hardening - hardening and field transfer, organ culture – meristem, embryo, anther, ovule culture, embryo rescue, somaclonal variation, protoplast culture and fusion.

Construction and identification of somatic hybrids and cybrids, wide hybridization, in vitro pollination and fertilization, haploids, in vitro mutation, artificial seeds, cryopreservation, rapid clonal propagation, genetic engineering in horticulture crops, use of molecular markers. In vitro selection for biotic and abiotic stress, achievements of biotechnology in horticultural crops.

Practicals

An exposure to low cost, commercial and homestead tissue culture laboratories, media preparation, inoculation of explants for clonal propagation, callus induction and culture, regeneration of plantlets from callus, sub-culturing, techniques on anther, ovule, embryo culture, somaclonal variation, in vitro mutant selection against abiotic stress, protoplast culture, fusion technique, development of protocols for mass multiplication, project development for establishment of commercial tissue culture laboratory.

Third Semester

SDMHC301: Advances in Post- Harvest Technology and Management of Fruits and Vegetables

Introduction, post harvest physio-biochemical changes; causes of post harvest losses, control of post harvest losses- proper cultural operations, pre-storage treatments, transportation, storage, environmental control, ionizing radiation, post harvest chemical treatments, storage of fresh fruits and vegetables, factor affecting storage quality, storage disorders, marketing of fruits and vegetables and their products.

History, objectives and scope of fruit and vegetable preservation, spoilage of fruits and vegetables, principles of preservation- temporary and permanent; vitamins and other nutrients in preserved products, food additives and their use in preservation. Principles and guidelines for establishing processing unit. Containers: Types, merits and demerits, composition and manufacturing of tin and glass containers, failures in glass containers, general principles and procedures of canning and bottling, spoilage of canned products. Principles and methods of jam, jelly and marmalade; theories of jelly formation, failures of jelly; unfermented fruit and vegetable beverages, juice extraction equipments, general methods of preparation and preservation, preservation of unfermented beverages.

General methods of making preserve and candy from some suitable fruits and vegetables, preparation of pickles, chutneys, sauces, ketchup, soup and cocktail from suitable fruits and vegetables, causes of spoilage.

Vinegar- quality standards, types, material processing and fermentation, methods of preparation, post-production processes, spoilage; pectin preparation. Sun drying- merits and demerits, procedure; mechanical dehydration of fruits and vegetables, home and commercial dehydrators, packing and storage. Preservation by freezing- objectives, freezing and growth of micro-organisms, freezing process, storage of frozen products; exposure on preservation by radiation.

Government policies, regulation and specifications for fresh and processed products.

Practicals- Identification of equipments used in preservation, canning of fruits and vegetables, cut out test for canned products, preparation of jam, jelly, squash, juice, preserve, chutney, ketchup, sauce, pickle; dehydration of potato, estimation of acidity, vitamin C, sugar, juice content and T.S.S., visit to processing factories.

SDMHC 302: Protected Cultivation of Horticultural Crops

Introduction, history, present status, importance, problems and prospects of protected cultivation. Types and designs of protected structures and their management. Environment control in protected structures. Growing media and sterilization. Soilless cultivation, hydro ponics and aeroponics. Irrigation and fertigation. Integrated insect pest and disease management

Vegetable seedlings production under protection. Protected cultivation of crops (media, bed preparation, varieties, planting, irrigation and fertigation, harvesting, specific operation for different crops and economics) rose, carnation, gerbera, orchids, anthurium. lilium, chrysanthemum, capsicum, tomatoes, exotic vegetables, potted ornamental plants.

Post harvest management of flowers and vegetable (sorting, grading, packing, storage, transportation and marketing).

Practicals

Study of different protected structures, cladding materials used, installation and their management. Study of environment control devices used in protected structures and measurement of temperature, RH, light and CO2. Study of growing media and sterilization. Study of irrigation and fertigation system and their management. Soilless cultivation. Hydroponics and aeroponics. Vegetable seedlings production under protection. Cultivation of Crops under protected environment: Rose, Carnation. Gerbera, Orchid and Anthurium, Lilium and chrysanthemum, Capsicum, Tomatoes, Exotic vegetables. Post harvest management of flowers and vegetable. Study of insect pests and diseases and their control. Visit to commercial green house projects.

SDMHC303: Advances in Floriculture and Landscaping

History, importance and scope, problems and prospects, styles of gardening, formal garden and its important parts. Landscaping- general principles, planning and designing, important elements, landscaping public buildings, educational institutions, factories, historical places. Bio-aesthetic planning , bonsai culture, flower forcing, role of colour in floriculture, exhibition, post harvest management.Origin and distribution, area and production, taxonomy and morphological features, classification and description of some important cultivars, propagation, special practices and problems, use of bioregulators: Rose Gladious Carnation Tuberose Marigold Gerbera Chrysanthemum Dahlia Baugainvillea Jaismines

Practicals- Identification of ornamental species, preparation of bonsai, use of bioregulators, judging, practice to conserve the life of cut flowers, morphological features of some ornamental plants, wintering in roses, preparation of shrubbery and herbaceous borders, propagation techniques, planning and layout for a garden, cost of cultivation of commercial flowers, visit to Ornamental Gardens.

SDMHC304:Advances in Orchard Management

Importance and scope of orchard management, constraint in fruit production, concept of high density planting. Orchard soil management systems, water requirement of fruit trees, factors affecting water requirement, classification of soil moisture, effect of soil moisture on fruit trees, disorders due to excess and deficient moisture, various factors affecting moisture supply to plants, drip and sprinkler irrigation, fertigation, multistory cropping, drainage systems, organic manures, fertilizers and bio fertilizers, role of elements in fruit production, disorders due to excess and deficiency of elements, evaluating need for nutrients/tissue analysis; integrated nutrient management(INM), Recent techniques of training and pruning, fruit thinning, splitting of fruits, preharvest fruit drop, rejuvenation of old orchards. Internal and external factors of unfruitfulness, practices to induce flowering; irregular bearing of fruit trees.Hardiness, winter killing, injuries and their protection, IPM, protection from important insects and diseases.

Practicals- Study of different systems of layout, planting, study of drip and sprinkler irrigation, identification and control of important diseases and insects, soil and foliar application of fertilizers, study of deficiency symptoms of elements, practice of pruning and training, rejuvenation of old orchards, tissue analysis, physical practices to induce flowering, use of bioregulators, cost of cultivation of an orchard, visit to important orchards and Fruit Research Stations.

Fourth Semester

SOAHE401: Biotic and Abiotic Stress Management in Horticultural Crops

Stress – definition, classification, stresses due to water (high and low), temperature (high and low), radiation, wind, soil conditions (salinity, alkalinity, ion toxicity, fertilizer toxicity, etc.).

Pollution - increased level of CO2, industrial wastes, impact of stress in horticultural crop production, stress indices, physiological and biochemical factors associated with stress, horticultural crops suitable for different stress situations.Crop modeling for stress situations, cropping system, assessing the stress through remote sensing, understanding adaptive features of crops for survival under stress, interaction among different stress and their impact on crop growth and productivity.Greenhouse effect and methane emission and its relevance to abiotic stresses, use of anti transpirants and PGRs in stress management, mode of action and practical use, HSP inducers in stress management techniques of soil moisture conservation, mulching, hydrophilic polymers.Rain water harvesting, increasing water use efficiency, skimming technology, contingency planning to mitigate different stress situations, cropping systems, stability and sustainability indices.

Practicals

Seed treatment /hardening practices, container seedling production, analysis of soil moisture estimates (FC, ASM, PWP), analysis of plant stress factors, RWC, chlorophyll flurosence, chlorophyll stability index, ABA content, plant waxes, stomatal diffusive resistance, transpiration, photosynthetic rate etc. under varied stress situations, influence of stress on growth and development of seedlings and roots, biological efficiencies, WUE, solar energy conversion and efficiency, crop growth sustainability indices, economics of stress management, visit to orchards and water shed locations.

SDMHE 402: Organic Horticulture

Organic horticulture – definition, synonyms and misnomers, principles, methods, merits and demerits.Organic farming systems, components of organic horticultural systems, different organic inputs,their role in organic horticulture, role of biofertilizers, biodynamic and the recent developments.EM technology and its impact in organic horticulture, indigenous practices of organic farming, sustainable soil fertility management, weed management practices in organic farming, biological/naturalcontrol of pests and diseases, organic horticulture in quality improvement. GAP - Principles and management, HACCP exercise, certification of organic products and systems, agencies involved at national and international levels, standards evolved by different agencies.

Constraints in certification, organic horticulture and export, IFOAM and global scenario of organic movement, post-harvest management of organic produce.

Practical

Features of organic orchards, working out conversion plan, Input analysis manures, nutrient status assessment of manures, biocomposting, biofertilizers and their application, pancha gavya preparation and other 20 organic nutrients application, methods of preparation of compost, vermicompost, green manuring, preparation of neem products and application, BD preparations and their role, EM technology and products, biological/natural control of pests and diseases, soil solarization, frame work for GAP, case studies, HACCP analysis, residue analysis in organic products, documentation for certification, visit to fields cultivated under organic practices.

Thesis: Objective and evaluation

Aim of introducing thesis in M. Sc.(Ag.) Horticulture is to give the students preliminary exposure for conducting the research and presenting its findings systematically and scientifically in a manuscript shape. To fulfill this goal, a specific topic for thesis research shall be assigned to each M. Sc. student by the teacher(s)/supervisor(s) of the department, in the first semester. The student will carry out the research for thesis under the respective supervisor(s) and finally present it in a book shape called thesis.

Each student will submit the thesis to the department/university towards the end of fourth semester of M. Sc. (Ag.) Horticulture degree.

Evaluation of Thesis:

The procedure will be as under:

i. Critical examination of thesis by the external expert appointed by the university as per specialization of thesis work.

ii. Each student shall give open presentation of thesis work before external/internal examiners, faculty members and students in the department.