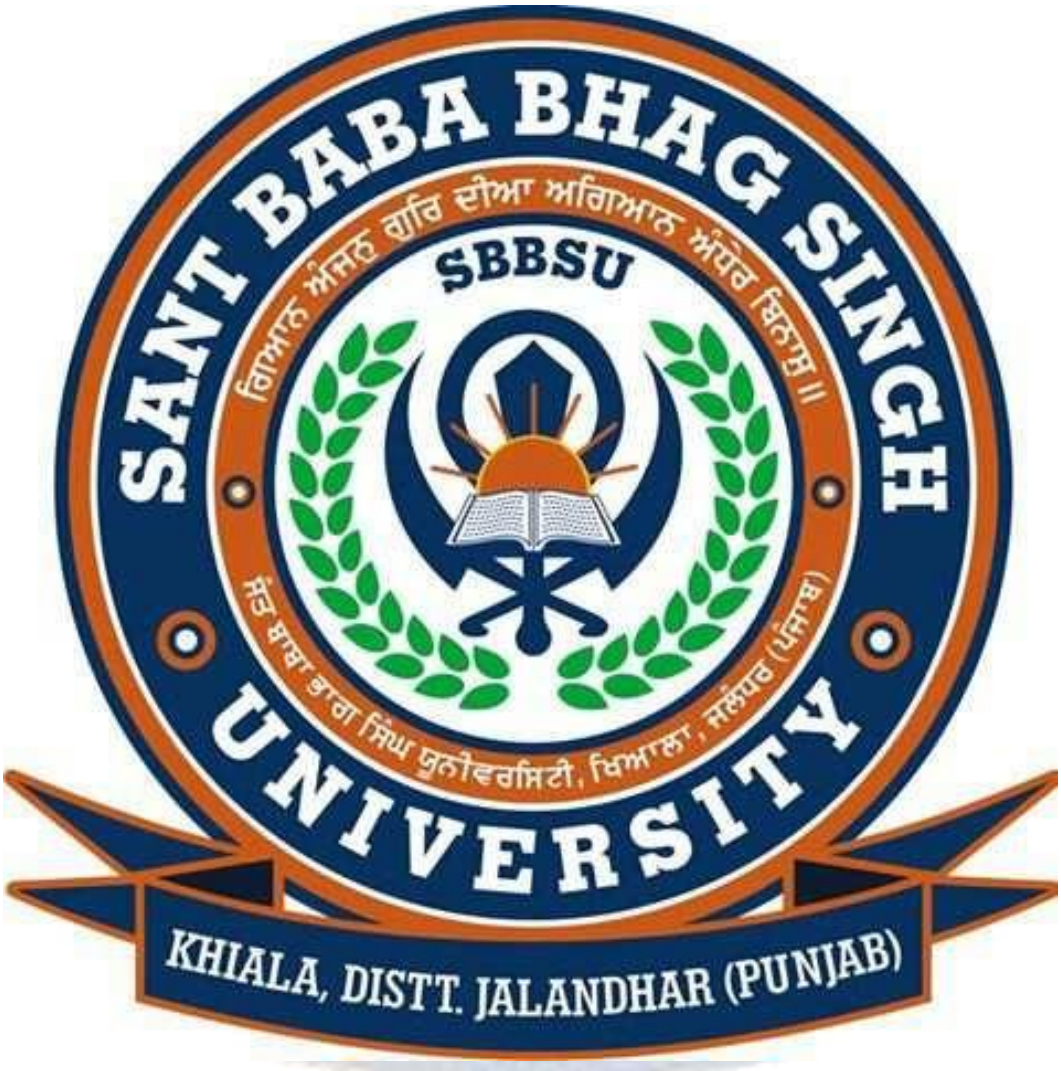
# SCHEME & SYLLABUS
# M.Sc. Ag. Horticulture (Vegetable Science)




## Department of Agricultural Sciences

## UISH

## Sant Baba Bhag Singh University

## 2019

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| | | | | | |
|---|---|---|---|---|---|
| **23** | AGR604-19 | Human rights and constitutional duties | **1+0** | **IV** | **39-40** |
| **24** | AGR606-19 | Agriculture research, research, ethics and rural development programme | **1+0** | **IV** | **41** |

*Compulsory for Master's programme

| List of Courses Offered | | | | |
|---|---|---|---|---|
| **Sr. No.** | **Subject Code** | **Subject** | **Credit** | **Semester** |
| **Major Courses** | | | | |
| **1.** | AGR570-19* | Production technology of warm season vegetable crops | 2+1 | II |
| **2.** | AGR571-19* | Production technology of cool season vegetable crops | 2+1 | I |
| **3.** | AGR572-19* | Breeding of vegetable crops | 2+1 | II |
| **4.** | AGR573-19* | Growth and development of vegetable crops | 2+1 | I |
| **5.** | AGR574-19 | Production technology of underexploited vegetable crops | 2 | II |
| **6.** | AGR575-19 | Systematics of vegetable crops | | I |
| **7.** | AGR515-19* | Master's Research | 0+4 | I |
| **8.** | AGR577-19 | Seed production technology of vegetable crops | | III |
| **9.** | AGR579-19 | Post harvest technology of vegetable crops | 2+1 | III |
| **10.** | AGR500-19* | Master's Research | 0+4 | II |
| **11.** | EVS601-19 | Disaster Management | 1+0 | III |
| **12.** | AGR601-19* | Master's Research | 0+4 | III |
| **13.** | AGR603-19* | Master's Seminar | 1+0 | III |
| **14.** | AGR605-19* | Master Comprehensive Exam | 0+2 | III |
| **15.** | AGR600-19* | Master's Research | 0+8 | IV |

| | | | | |
|---|---|---|---|---|
| **Minor Courses** | | | | |
| **1.** | AGR550-19 | Soil erosion and conservation | **2+1** | **II** |
| **2.** | AGR552-19 | Soil, water and air pollution | **2+1** | **II** |
| **Supporting Courses** | | | | |
| **3.** | MAT529-19 | Experimental designs | **2+1** | **I** |
| **4.** | LIB601-19 | Library and information services | **0+1** | **I** |
| **5.** | CSE551-19 | Computer fundamentals and programming | **2+1** | **I** |
| **Interdisciplinary Courses** | | | | |
| **6.** | EVS601-19 | Disaster management | **1+0** | **III** |
| **7.** | BOT522-19 | Intellectual property and its management in agriculture | **2+0** | **II** |
| **8.** | AGR602-19 | Technical writing and communications skills | **0+1** | **IV** |
| **9.** | AGR604-19 | Human rights and constitutional duties | **1+0** | **IV** |
| **10.** | AGR606-19 | Agriculture research, research, ethics and rural development programme | **1+0** | **IV** |
| *Compulsory for Master's program | | | | |

## CREDIT LOAD FOR MASTERS PROGRAM

| | | |
|---|---|---|
| **I** | **MAJOR CREDITS** | **22** |
| **II** | **MINOR CREDITS** | **06** |
| **III** | **SUPPORTING** | **07** |
| **IV** | **INTERDISCIPLINARY CREDITS** | **06** |
| **V** | **MASTER'S COMPREHENSIVE** | **02** |
| **VI** | **MASTER'S SEMINAR** | **01** |
| **VII** | **MASTER'S RESEARCH** | **20** |
| **TOTAL I to VI** | | **44** |
| | **TOTAL** | **44+20 = 64** |

# M. Sc. Ag. Horticulture (Vegetable Science) scheme

| SEMESTER-I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sr. No** | **Subject Code** | **Type of Course** | **Subject Name** | **Credits (L:T:P)** | **Contact Hours (L:T:P)** | **Total Contact Hours** | **Total Credit Hours** |
| 1 | AGR571-19 | CR | Production technology of cool season vegetable crops | 2:0:1 | 2:0:2 | 4 | 3 |
| 2 | AGR573-19 | CR | Growth and development of vegetable crops | 2:0:1 | 2:0:2 | 4 | 3 |
| 3 | AGR575-19 | CR | Systematics of vegetable crops | 1:0:1 | 1:0:2 | 3 | 2 |
| 4 | MAT529-19 | SC | Experimental designs | 2:0:1 | 2:0:2 | 4 | 3 |
| 5 | CSE551-19 | SC | Computer fundamentals and programming | 2:0:1 | 2:0:2 | 4 | 3 |
| 6 | AGR515-19 | CR | Master's Research | 0:0:4 | 0:0:8 | 8 | 4 |

**Total Credit Hours: 18**
**Total Contact Hours: 27**

**CR-Core Course**
**SC- Supporting Course**

| SEMESTER-II | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Subject Code** | **Type of course** | **Subject Name** | **Credits (L:T:P)** | **Contact Hours (L:T:P)** | **Total Contact Hours** | **Total Credit Hours** |
| 1 | AGR570-19 | DEC | Production technology of warm season vegetable crops | 2:0:1 | 2:0:2 | 4 | 3 |
| 2 | AGR572-19 | CR | Breeding of vegetable crops | 2:0:1 | 2:0:2 | 4 | 3 |
| 3 | AGR574-19 | DEC | Production technology of underexploited vegetable crops | 1:0:1 | 1:0:2 | 3 | 2 |
| 4 | AGR550-19 | MC | Soil erosion and conservation | 2:0:1 | 2:0:2 | 4 | 3 |
| 5 | AGR552-19 | MC | Soil, water and air pollution | 2:0:1 | 2:0:2 | 4 | 3 |
| 6 | AGR500-19 | CR | Master's Research | 0:0:4 | 0:0:8 | 8 | 4 |
| 7 | BOT522-19 | IC | Intellectual Property Rights | 2:0:0 | 2:0:0 | 2 | 2 |

**Total Credit Hours: 20**
**Total Contact hrs: 29**

**CC-Core Course**
**MC- Minor Course**
**IC- Interdisciplinary Course**
**DEC- Departmental Elective Course**

| SEMESTER-III | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Subject Code** | **Type of course** | **Subject Name** | **Credits (L:T:P)** | **Contact Hours (L:T:P)** | **Total Contact Hours** | **Total Credit Hours** |
| 1 | EVS501-19 | IC | Disaster management | 1:0:0 | 1:0:0 | 1 | 1 |
| 2 | AGR577-19 | DEC | Seed production technology of vegetable crops | 2:0:1 | 2:0:2 | 4 | 3 |
| 3 | LIB501-19 | SC | Library and information services | 0:0:1 | 0:0:2 | 2 | 1 |
| 4 | AGR579-19 | CR | Post harvest technology of vegetable crops | 2:0:1 | 2:0:2 | 4 | 3 |
| 5 | AGR603-19 | CR | Master's Seminar | 1:0:0 | 1:0:0 | 1 | 1 |
| 6 | AGR605-19 | CR | Master's Comprehensive | 0:0:2 | 0:0:4 | 4 | 2 |
| 7 | AGR601-19 | CR | Master's Research | 0:0:4 | 0:0:8 | 8 | 4 |

**Total Credit Hours: 15**
**Total Contact hours: 24**

**CR-Core Course**
**IC- Interdisciplinary Course**
**DEC- Departmental Elective Course**
**SC- Supporting Course**

| SEMESTER-IV | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Subject Code** | **Type of Course** | **Subject Name** | **Credits (L:T:P)** | **Contact Hours (L:T:P)** | **Total Contact Hours** | **Total Credit Hours** |
| 1 | AGR600-19 | CR | Masters Research | 0:0:8 | 0:0:16 | 16 | 8 |
| 2 | AGR602-19 | IC | Technical Writing and communication skills | 0:0:1 | 0:0:2 | 2 | 1 |
| 3 | AGR604-19 | IC | Human rights and constitutional duties | 1:0:0 | 1:0:0 | 1 | 1 |
| 4 | AGR606-19 | IC | Agriculture research, research, ethics and rural development programme | 1:0:0 | 1:0:0 | 1 | 1 |

**Total Credit Hours: 11**
**Total Contact hours: 20**

**CR-Core Courses**
**IC- Interdisciplinary Courses**

## Course Scheme Summary

| Semester | L | T | P | Contact hrs/wk | Credits |
|---|---|---|---|---|---|
| 1 | 9 | - | 18 | 27 | 18 |
| 2 | 11 | - | 18 | 29 | 20 |
| 3 | 6 | - | 18 | 24 | 15 |
| 4 | 1 | - | 18 | 20 | 11 |
| **Total** | **27** | **0** | **72** | **100** | **64** |

# SEMESTER-I

| Course Code | AGR571-19 |
|---|---|
| **Course Title** | **Production technology for cool season vegetable crops** |
| **Type of course** | Theory & Practical |
| **L T P** | 2 0 1 |
| **Credits** | 3 (2 +1) |
| **Course prerequisite** | B.Sc (Agriculture) |
| **Course objectives (CO)** | To educate production technology of cool season vegetables. |

## Syllabus

**Theory**

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

**Crops**

**UNIT I-** Potato

**UNIT II-** Cole crops: cabbage, cauliflower, knoll 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**

1. Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of winter vegetable crops and their economics
2. Experiments to demonstrate the role of mineral elements
3. Plant growth substances and herbicides
4. Study of physiological disorders,
5. Preparation of cropping scheme for commercial farms.
6. visit to commercial greenhouse/ polyhouse

## Recommended Books:

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Vegetable Production in India | DVS Chauhan | Ram Parsad & Sons |
| 2 | Hand Book of Horticulture | K L Chadha | ICAR |
| 3 | Package and Practices of Vegetables | - | PAU |

| | |
|---|---|
| **Course Code** | **AGR573-19** |
| **Course Title** | **Growth and development of vegetable crops** |
| **Type Course** | Theory & Practical |
| **L T P** | 2 0 1 |
| **Credits** | 3 (2 +1) |
| **Course Pre-requisite** | B.Sc (Agriculture) |
| **Course Objective (CO)** | To teach the physiology of growth and development of vegetable crops. |

## Syllabus

**UNIT-I**

Cellular structures and their functions; definition of growth and development, growth analysis and its importance in vegetable production.

**UNIT-II**

Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellilns, cyktokinins and abscissic acid; Application of synthetic hormones, plant growth retardants and inhibitors for various purposes in vegetable crops; Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plant stimulants in vegetable crop production.

**UNIT-III**

Role of light, temperature and photoperiod on growth,development of underground parts, flowering and sex expression in vegetable crops; apical dominance.

**UNIT-IV**

Physiology of fruit set, fruit development, fruit growth, flower and fruit drop; parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission; fruit ripening and physiological changes associated with ripening.

**UNIT- V**

Plant growth regulators in relation to vegetable production; morphogenesis and tissue culture techniques in vegetable crops.

**Practical**

1. Preparation of solutions of plant growth substances and their application
2. Experiments in breaking and induction of dormancy by chemicals
3. Induction of parthenocarpy and fruit ripening
4. Application of plant growth substances for improving flower initiation, changing sex expression in cucurbits and checking flower and fruit drops and improving fruit set in solanaceous vegetables,
5. Growth analysis techniques in vegetable crops

## Recommended books:-

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Application Plant Growth Substances and Their Uses in Agriculture | HN Krishnamoorti | Tata-McGraw Hill |

| | |
|---|---|
| **Course Code** | **AGR575-19** |
| **Course Title** | **Systematics of vegetable crops** |
| **Type Course** | Theory & Practical |
| **L T P** | 1 0 1 |
| **Credits** | 2(1 +1) |
| **Course Pre-requisite** | B.Sc (Agriculture) |
| **Course Objective (CO)** | To teach morphological, cytological and molecular taxonomy of vegetable crops. |

**Syllabus**

**Theory**

**UNIT I**

Principles of classification; different methods of classification; salient features of international code of nomenclature of vegetable crops

**UNIT II**

Origin, history, evolution and distribution of vegetable crops, botanical description of families, genera and species covering various tropical, subtropical and temperate vegetables.

**UNIT III**

Cytological level of various vegetable crops; descriptive keys for important vegetables

**UNIT IV**

Importance of molecular markers in evolution of vegetable crops; molecular markers as an aid in characterization and taxonomy of vegetable crops.

**Practical**

1. Identification, description, classification and maintenance of vegetable species and varieties
2. Survey, collection of allied species and genera locally available
3. Preparation of keys to the species and varieties
4. Methods of preparation of herbarium and specimens.

## Recommended books:-

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Genetics and Breeding of Vegetables. (Revised) | Peter KV & Pradeep kumar T. | ICAR |
| 2 | A Class Book of Botany | Dutta AC | Oxford Univ. Press. |

| Course Code | MAT529-19 |
|---|---|
| **Course Title** | **Experimental designs** |
| **Type of Course** | Theory |
| **L T P** | 2 0 1 |
| **Credits** | 3(2 +1) |
| **Course Prerequisite** | B.Sc (Agriculture) |
| **Course Objectives (CO)** | Mathematics is really a great tool to understand the things correctly. The aim of the course is to enable students : (1) To understand the theory knowledge as well as practical knowledge of different formulas.(2) To inculcate the skills to use different methods to solve the applied problems. |

## Syllabus

**UNIT-I**

Need for designing of experiments, characteristics of a good design, basic principles of designs - randomization, replication and local control. Uniformity trials, analysis of variance and interpretation of data, transformations, orthogonality and partitioning of degrees of freedom.

**UNIT-II**

Completely randomized design, randomized block design and Latin square design, repeated Latin square design, analysis of covariance and missing plot techniques in randomized block and Latin square designs.

**UNIT-III**

Factorial experiments (symmetrical as well as asymmetrical), confounding in symmetrical factorial experiments, factorial experiments with control treatment.

**UNIT-IV**

Split plot and strip plot designs, crossover designs, balanced incomplete block design, lattice design-concepts, randomization procedure, analysis and interpretation of results, experiments with mixtures.

**Practical**:

1. Analysis of data obtained from CRD, RBD, LSD
2. Analysis of factorial experiments with and without confounding
3. Analysis with missing data; balanced incomplete block design; split plot and strip plot designs; transformation of data
4. Analysis of lattice design.

## Recommended books:

| S. No | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Statistical Method for Research workers | Singh, S, Singh, T.P Babsal, M.L and Kumar R | Kalyani Publishers, Ludhiana |
| 2 | Statistical methods for agricultural workers, | Panse, V.G., Shaw, F.J., and Sukhatme, P.V. | Indian Council of Agricultural Research, |

| | |
|---|---|
| **Course Code** | **CSE551-19** |
| **Course Title** | **COMPUTER FUNDAMENTALS AND PROGRAMMING** |
| **Type of course** | Theory & Practical |
| **L T P** | 2 0 1 |
| **Credits** | 3(2 +1) |
| **Course prerequisite** | B.Sc (Agriculture)/CSE |
| **Course Objectives (CO)** | To impart comprehensive knowledge about the computer fundamentals and programming |

## Syllabus

## Theory

**UNIT I**

Computer Fundamentals- number system, decimal, octal, binary and hexadecimal representation of integers, fixed and floating point numbers, character representation ASCII,EBCDIC. Functional units of computer, I/O devices, primary and secondary memories.

**UNIT-II**

Programming fundamentals with C-algorithm, techniques of problem solving, flowcharting, stepwise refinement ,representation of integer, character, real, data types, constants and variables, arithmetic expressions, assignment statement, logical expression

**UNIT-III**

Sequencing, alteration and iteration, arrays, string processing

**UNIT-IV**

Sub programs, recursion, pointers and files. Program correctness, debugging and testing of programs .

**Practical**:

1. Conversion of different number types; creation of flow chart;
2. conversion of algorithm /flowchart to program; mathematical operators; operator precedence; sequence, control and iteration; arrays and string processing; pointers and file processing

## Recommended books:

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Digital Logic and Computer Design. | MM. Mano 1999 | Prentice Hall of India |
| 2 | Digital Computer Electronics | AP Malvino & JA.Brown 1999 | Tata McGraw Hill |

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|---|---|
| **Course Code** | **AGR515-19** |
| **Course Title** | **Master's Research** |
| **Type of course** | Practical |
| **L T P** | 0 0 4 |
| **Credits** | 4(0 + 4) |
| **Course prerequisite** | B.Sc (Agriculture) |

Master's Research

# SEMESTER II

| Course Code | AGR570-19 |
|---|---|
| **Course Title** | **Production technology for warm season vegetable crops** |
| **Type of course** | Theory & Practical |
| **L T P** | 2 0 1 |
| **Credits** | 2 +1 |
| **Course prerequisite** | B.Sc (Agriculture) |
| **Course objectives (CO)** | To teach production technology of warm season vegetables. |

## Syllabus

### Theory

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

**UNIT I-** Tomato, eggplant, hot and sweet peppers
**UNIT II-** Okra, beans, cowpea and clusterbean
**UNIT III-** Cucurbitaceous crops
**UNIT IV-** Tapioca and sweet potato
**UNIT V -** Green leafy warm season vegetables

### Practical

1. Maturity Standards, Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of summer vegetable crops and their economics
2. Study of physiological disorders and deficiency of mineral elements
3. Preparation of cropping schemes for commercial farms
4. Experiments to demonstrate the role of mineral elements
5. Plant growth substances and herbicides
6. Seed extraction techniques
7. Identification of important pests and diseases and their control

**Recommended Books:**

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Vegetable Production in India | DVS Chauhan | Ram Parsad & Sons |
| 2 | Hand Book of Horticulture | - | ICAR |
| 3 | Package and Practices of Vegetables | - | PAU |

| Course Code | AGR572-19 |
|---|---|
| **Course Title** | **Breeding of Vegetable Crops** |
| **Type of course** | Theory & Practical |
| **L T P** | 2 0 1 |
| **Credits** | 2 +1 |
| **Course prerequisite** | B.Sc (Agriculture) |
| **Course Objectives (CO)** | To educate principles and practices adopted for breeding of vegetable crops |

## Syllabus

**Theory:**

Origin, botany, taxonomy, cytogenetics, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, molecular marker, genomics, marker assisted breeding and QTLs, biotechnology and their use in breeding in vegetable crops-Issue of patenting, PPVFR act.

**UNIT I-** Potato and tomato
**UNIT II-** Eggplant, hot pepper, sweet pepper and okra
**UNIT III-** Peas and beans, amaranth, chenopods and lettuce
**UNIT IV-** Gourds, melons, pumpkins and squashes
**UNIT V-** Cabbage, cauliflower, carrot, beetroot, radish, sweet potato and tapioca

**Practical**

1. Selection of desirable plants from breeding population observations and analysis of various qualitative and quantitative traits in germplasm
2. Hybrids and segregating generations
3. Induction of flowering, palanological studies, selfing and crossing techniques in vegetable crops
4. Hybrid seed production of vegetable crops in bulk.
5. Screening techniques for insect-pests, disease and environmental stress resistance in vegetables crops
6. Demonstration of sib-mating and mixed population
7. Molecular marker techniques to identify useful traits in the vegetable crops and special breeding technique.

**Recommended Books:**

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Techniques of developing hybrids in vegetable crops | Kumar JC & Dhaliwal MS | Agro Botanical |
| 2 | Genetics and breeding of vegetables | K V Peter and T. Pardeep Kumar | ICAR |

| | |
|---|---|
| **Course Code** | **AGR574-19** |
| **Course Title** | **Production technology of underexploited vegetable crops** |
| **Type Course** | Theory & Practical |
| **L T P** | 2 0 1 |
| **Credits** | 3(2 +1) |
| **Course Pre-requisite** | B.Sc (Agriculture) |
| **Course Objective (CO)** | To educate production technology of underutilized vegetable crops. |

## Syllabus

### Theory

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and 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**

Asparagus, artichoke and leek

**UNIT II**

Brussels's sprout, Chinese cabbage, broccoli, kale and artichoke.

**UNIT III**

Amaranth, celery, parsley, parsnip, lettuce, rhubarb, spinach, basella, bathu (chenopods) and chekurmanis

**UNIT IV**

Elephant foot yam, lima bean, winged bean, vegetable pigeon pea, jack bean and sword bean

**UNIT V**

Sweet gourd, spine gourd, pointed gourd, Oriental pickling melon and little gourd (kundru).

### Practical

1. Identification of seeds
2. Botanical description of plants
3. Layout and planting
4. Cultural practices

## Recommended books:-

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Unexploited Tropical Vegetables | Indira P & Peter KV. | |
| 2 | Underutilized and Underexploited Horticultural Crops. | Peter KV. (Ed.). | New India Publ. Agency. |

| | |
|---|---|
| **Course Code** | **AGR550-19** |
| **Course Title** | **Soil erosion and conservation** |
| **Type of course** | Theory & Practical |
| **L T P** | 2 0 1 |
| **Credits** | 3(2 +1) |
| **Course prerequisite** | B.Sc (Agriculture) |
| **Course Objectives (CO)** | To study the impact of erosion on soil, water and air quality and how to conserve soil erosion |

## Syllabus

**Theory**

**UNIT I**

History, distribution, identification and description of soil erosion problems in India. Forms of soil erosion, effects of soil erosion and factors affecting soil erosion, types and mechanisms of water erosion, raindrops and soil erosion, rainfall erosivity - estimation as EI30 index and kinetic energy, factors affecting water erosion, empirical and quantitative estimation of water erosion, methods of measurement and prediction of runoff, soil losses in relation to soil properties and precipitation.

**UNIT II**

Wind erosion- types, mechanism and factors affecting wind erosion, extent of problem in the country. Principles of erosion control, erosion control measures – agronomical and engineering, erosion control structures - their design and layout.

**UNIT III**

Soil conservation planning, land capability classification, soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands.

**UNIT IV**

Watershed management - concept, objectives and approach, water harvesting and recycling, flood control in watershed management, socioeconomic aspects of watershed management, case studies in respect to monitoring and evaluation of watersheds, use of remote sensing in assessment and planning of watersheds.

**Practical:**

1. Determination of different soil erodibility indices - suspension percentage; dispersion ratio; erosion ratio; clay ratio; clay/moisture equivalent ratio; percolation ratio; raindrop erodibility index;
2. Computation of kinetic energy of falling rain drop
3. Computation of rainfall erosivity index using rain gauge data
4. Visits to a watershed.

**Recommended books:-**

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Soil Erosion and conservation | R.P.C. Morgan | Wiley Blackwill |
| 2 | Soil erosion and how to prevent it | Natalie Hyde | Crabtree Publishing Company |

| | |
|---|---|
| **Course Code** | **AGR552-19** |
| **Course Title** | **Soil, water and air pollution** |
| **Type of course** | Theory & Practical |
| **L T P** | 2 0 1 |
| **Credits** | 3(2+1) |
| **Course prerequisite** | B.Sc (Agriculture) |
| **Course Objectives (CO)** | To study the pollution impact on soil, air & water and its remediation |

## Syllabus

**Theory**

**UNIT I**

Soil, water and air pollution problems associated with agriculture, nature and extent. Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc., air, water and soil pollutants - their CPC standards and effect on plants, animals and human beings.

**UNIT II**

Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings, soil as sink for waste disposal. Pesticides – their classification, behavior in soil and effect on soil microorganisms.

**UNIT III**

Toxic elements – their sources, behavior in soils, effect on nutrients availability, effect on plant and human health. Pollution of water resources due to leaching of nutrients and pesticides from soil, emission of greenhouse gases – carbon dioxide, methane and nitrous oxide.

**UNIT IV**

Remediation/amelioration of contaminated soil and water, remote sensing applications in monitoring and management of soil and water pollution.

**Practical**:

1. Sampling of sewage waters; sewage sludge; solid/liquid industrial wastes; polluted soils and plants
2. Estimation of dissolved and suspended solids; chemical oxygen demand (COD); biological oxygen demand (BOD); nitrate and ammonical nitrogen and phosphorus; heavy metal content in effluents; heavy metals in contaminated soils and plants.

**Recommended books:-**

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Soil Erosion and conservation | R.P.C. Morgan | Wiley Blackwill |
| 2 | Environment degradation and Global Health | Ashwani Kumar Dubey | Daya Publishing house |

| | |
|---|---|
| **Course Code** | **AGR500-19** |
| **Course Title** | **Master's Research** |
| **Type of course** | Practical |
| **L T P** | 0 0 4 |
| **Credits** | 4 (0+ 4) |
| **Course prerequisite** | B.Sc (Agriculture) |

Master's Research

| | |
|---|---|
| **Course Code** | **BOT522-19** |
| **Course Title** | Intellectual property and its management in agriculture |
| **Type of course** | Theory |
| **L T P** | 2:0:0 |
| **Credits** | 2(2+0) |
| **Course prerequisite** | B.Sc. (Agriculture) |
| **Course Objectives** | 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. |

## Syllabus

## Theory

**UNIT-I**

Historical perspectives and need for the introduction of Intellectual Property Right regime. TRIPs and various provisions in TRIPS Agreement. Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs.

**UNIT-II**

Indian Legislations for the protection of various types of Intellectual Properties. Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection

**UNIT-III**

Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection. National Biodiversity protection initiatives. Convention on Biological Diversity.

**UNIT-IV**

International Treaty on Plant Genetic Resources for Food and Agriculture. Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

## Recommended books:

| S. No | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Law related to intellectual property | Dr. B.L. Wadehra | Universal law publishing |
| 2 | Law relating to intellectual property rights | V.K. Ahuja | Universal law publishing |

# SEMESTER-III

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|---|---|
| **Course Code** | **AGR577-19** |
| **Course Title** | **Seed production technology of vegetable Crops** |
| **Type Course** | Theory & Practical |
| **L T P** | 1 0 1 |
| **Credits** | 2(1 +1) |
| **Course Pre-requisite** | B.Sc (Agriculture) |
| **Course Objective (CO)** | To educate principles and methods of quality seed and planting material production in vegetable crops |

## Syllabus

### Theory

**UNIT I**

Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India

**UNIT II**

Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production.

**UNIT III**

Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control.

**UNIT IV**

Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/packets), storage and cryopreservation of seeds, synthetic seed technology

**UNIT V**

Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, leafy vegetables, okra, vegetatively propagated vegetables.

### Practical

1. Seed sampling, seed testing (genetic purity, seed viability, seedling vigour, physical purity) and seed health testing
2. Testing, releasing and notification procedures of varieties
3. Floral biology; rouging of off-type
4. Methods of hybrid seed production in important vegetable and spice crops
5. Seed extraction techniques
6. Handling of seed processing and seed testing

## Recommended books:-

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Techniques in Seed Science and Technology | Agrawal PK & Dadlani M. | South Asian Publication |
| 2 | Techniques of Developing Hybrids in Vegetable Crops | Kumar JC & Dhaliwal MS | Agro Botanical Publication |

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|---|---|
| **Course Code** | **AGR579-19** |
| **Course Title** | **Post Harvest Technology of vegetable crops** |
| **Type Course** | Theory & Practical |
| **L T P** | 2 0 1 |
| **Credits** | 3 (2 +1) |
| **Course Pre-requisite** | B.Sc (Agriculture) |
| **Course Objective (CO)** | To educate principles and practices of processing of vegetable crops |

## Syllabus

**UNIT-I**

History of food preservation. Present status and future prospects of vegetable preservation industry in India.

**UNIT-II**

Spoilage of fresh and processed horticultural produce; biochemical changes and enzymes associated with spoilage of horticultural produce; principal spoilage organisms, food poisoning and their control measures. Role of microorganisms in food preservation.

**UNIT-III**

Raw materials for processing. Primary and minimal processing; processing equipments; Layout and establishment of processing industry, FPO licence. Importance of hygiene; Plant sanitation. Quality assurance and quality control, TQM, GMP. Food standards – FPO,PFA, etc. Food laws and regulations.

**UNIT-IV**

Food safety – Hazard analysis and critical control points (HACCP). Labeling and labeling act, nutrition labeling. Major value added products from vegetables.Utilization of byproducts of vegetable processing industry; Management of waste from processing factory. Investment analysis. Principles and methods of sensory evaluation of fresh and processed vegetables.

**Practical**:

1. Study of machinery and equipments used in processing of horticultural produce;
2. Chemical analysis for nutritive value of fresh and processed vegetables;
3. Study of different types of spoilages in fresh as well as processed horticultural produce;
4. Classification and identification of spoilage organisms;
5. Study of biochemical changes and enzymes associated with spoilage;
6. Laboratory examination of vegetable products; Sensory evaluation of fresh and processed vegetables;

7. Study of food standards – National, international, CODEX Alimentarius;
8. Visit to processing Sections to study the layout, equipments, hygiene, sanitation and residual / waste management

**Recommended books:-**

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Post Harvest Physiology and Storage of horticultural crops | Mitra SK. | CABI |

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|---|---|
| **Course Code** | **EVS 601-19** |
| **Course Title** | **Disaster Management** |
| **Type of course** | Theory |
| **L T P** | 1 0 0 |
| **Credits** | 1(1 +0) |
| **Course prerequisite** | B.Sc (Agriculture) |
| **Course Objective(CO)** | 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 |

## Syllabus

**UNIT-I**

Natural Disasters -Meaning and nature of natural disasters, their types and effects Floods,drought,cyclone,earthquake,landslides,avalanches,volcanic eruptions, Heat and cold waves, climatic change: global warming, sea level rise, ozone depletion

**UNIT-II**

Manmade disasters-Nuclear disasters, chemical disasters, biological disasters , building fire, coal fire, forest fire, field fires-burning of straw, stables and residues oil fire, air pollution water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, sea accidents

**UNIT-III**

Disaster management-effect to mitigate natural disaster at national and global level, International strategy for disaster reduction, Concept of disaster management ,national disaster management framework; financial arrangements

**UNIT-IV**

Role of NGOs community-based organizations and media .Central, state, district and local administration; armed forces in disaster response, Disaster response ;Police and other organizations.

**Recommended Books:**

| S. No | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Disaster Management future challenges and Opportunities | Jagbir singh | IK International Publishing House Pvt.Ltd. |
| 2 | National hazards and disaster management | R.B.Singh | UBS |

| Course Code | LIB601-19 |
|---|---|
| **Course Title** | **Library and Information Services** |
| **Type of course** | Theory |
| **L T P** | 0 0 1 |
| **Credits** | 1 (0 +1) |
| **Course prerequisite** | B.Sc (Agriculture) |
| **Course Objectives (CO)** | 1.Educate and assist students in the identification and effective use of information resources<br>2. Provide current library materials and databases that support the academic curriculum |

## Syllabus

**UNIT- I**

Introduction to library services; Role of libraries in University education, research, extension and technology transfer;

**UNIT- II**

Classification systems and organization of Library; Sources of information Primary Sources, Secondary Sources and Tertiary Sources, with emphasis on reference tools and digital resources; Intricacies of abstracting and indexing, CAS, SDI services, (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts etc.);

**UNIT-III**

Tracing information from reference sources, information explosion and language barrier; Literature survey; Citation techniques/Bibliographic control and Preparation of bibliography;

**UNIT-IV**

Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-abbreviations likeibid etc

## Recommended books:

| S.No. | Name | Author(S) | Publisher |
|---|---|---|---|
| 1. | Manual of Library and Information Services | Bhanu Pratap | STUDERA PRESS |

| | |
|---|---|
| **Course Code** | **AGR 603-19** |
| **Course Title** | **Master's Seminar** |
| **Type of course** | Practical |
| **L T P** | 1 0 0 |
| **Credits** | 1(1 +0) |
| **Course prerequisite** | B.Sc (Agriculture) |

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|---|---|
| **Course Code** | **AGR605-19** |
| **Course Title** | **Master's Comprehensive Exam** |
| **Type of course** | Practical |
| **L T P** | 0 0 2 |
| **Credits** | 2(0 +2) |
| **Course prerequisite** | B.Sc (Agriculture) |

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|---|---|
| **Course Code** | **AGR601-19** |
| **Course Title** | **Master's Research** |
| **Type of course** | Practical |
| **L T P** | 0 0 4 |
| **Credits** | 4(0 + 4) |
| **Course prerequisite** | B.Sc (Agriculture) |

# SEMESTER-IV

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|---|---|
| **Course Code** | **AGR600-19** |
| **Course Title** | **Master's Research** |
| **Type of course** | Practical |
| **L T P** | 0 0 8 |
| **Credits** | 8 (0 + 8) |
| **Course prerequisite** | B.Sc (Agriculture) |

Master's Research

| Course Code | AGR602-19 |
|---|---|
| **Course Title** | **Technical Writing and communications skills** |
| **Type of course** | Practical |
| **L T P** | 0:0:2 |
| **Credits** | 1(0+1) |
| **Course prerequisite** | B.Sc. (Agriculture) |
| **Course Objectives** | To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing). |

## Practicals:

1. Various forms of scientific writings- thesis, technical papers, reviews, manuals, etc.
2. Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion).
3. Writing of abstracts, summaries, précis, citations etc.
4. Commonly used abbreviations in the theses and research communications.
5. Illustrations, photographs and drawings with suitable captions.
6. Pagination, numbering of tables and illustrations.
7. Writing of numbers and dates in scientific write-ups. Editing and proof-reading.
8. Writing of a review article.
9. Grammar (Tenses, parts of speech, clauses, punctuation marks).
10. Error analysis (Common errors), concord, collocation.
11. Phonetic symbols and transcription, accentual pattern, weak forms in connected speech.
12. Participation in group discussion, facing an interview, presentation of scientific papers.

## Recommended books:

| S. No | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Technical writing and communication: theory and practices | Deb Dulal Halder, Anjana Neira Dev & Prerna Malhotra | Book age publications |

| Course Code | AGR604-19 |
|---|---|
| **Course Title** | **Human rights and constitutional duties** |
| **Type of course** | Theory |
| **L T P** | 1:0:0 |
| **Credits** | 1(1+0) |
| **Course prerequisite** | B.Sc. (Agriculture) |
| **Course Objectives** | To study the human rights and its actual status |

## Syllabus

## Theory

**UNIT-I**

Introduction to human rights. Foundational Aspects: Meaning, Nature, Classification**.** Evolution of the Concept: Magna Carta to Universal Declaration of Human Rights; Generations of Human Rights.

**UNIT-II**

Conceptual Perspective: Meaning, Nature & Characteristics of Human Duties; Classification of Human Duties; Relevance of Human Duties

Human Duties in India: Fundamental Duties in Indian Constitution Part IV A

(a) To abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
(b) To cherish and follow the noble ideals which inspired our national struggle for freedom;
(c) To uphold and protect the sovereignty, unity and integrity of India;
(d) To defend the country and render national service when called upon to do so;
(e) To promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
(f) To value and preserve the rich heritage of our composite culture;
(g) To protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures;
(h) To develop the scientific temper, humanism and the spirit of inquiry and reform;
(i) To safeguard public property and to abjure violence;
(j) To strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;

(k) Who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.)

**UNIT-III**

Concept of human rights in India. Constitutional-Legal Framework: Fundamental Rights; Directive Principles of State Policy Governmental Institutions for the Protection of Human Rights: Working of National Human Rights Commission; National Commission for Women.

**UNIT-IV**

Actual status of human rights in India. Status of Economic Social & Cultural Rights in India: Violence against Women; Violation of Child Rights: An Appraisal. State of Civil & Political Rights in India: A study of Jammu & Kashmir and the North-East.

## Recommended books:

| S. No | Name | Author(S) | Publisher |
|---|---|---|---|
| 1 | Introduction to Human Rights and Duties | S.N.Shastry | University of Pune Press, 2011 |
| 2 | Human duties and limits of human right | Eric R Boot | Springer |

| | |
|---|---|
| **Course Code** | **AGR606-19** |
| **Course Title** | **Agriculture research, research, ethics and rural development programme** |
| **Type of course** | Theory |
| **L T P** | 1:0:0 |
| **Credits** | 1(1+0) |
| **Course prerequisite** | B.Sc. (Agriculture) |
| **Course Objectives** | To sensitize the scholars about the basic issues related with agricultural research, ethics in research as well as rural development. |

## Syllabus

## Theory

**UNIT-I**

History of agriculture in brief. Global agricultural research system: need, scope, opportunities. Role in promoting food security, reducing poverty and protecting the environment. National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions. Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels. International fellowships for scientific mobility.

**UNIT-II**

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

**UNIT-III**

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme. Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP).

**UNIT-IV**

Panchayati Raj, Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

## Recommended books:

| S. No | Name | Author(S) | Publisher |
|---|---|---|---|
| 1. | Rural Development- Principles, Policies and Management. | K Singh | Sage Publ. |
| 2. | Manual on International Research and Research Ethics | M.S. Punia | CCS, Haryana Agricultural University, Hisar. |


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