

# **FACULTY OF AGRICULTURE**

## **SYLLABUS**

*For*

**M.Sc. Ag. Horticulture (Vegetable Science)**

**(Semester: I–IV)**

**Session: 2020-21**

**KHALSA COLLEGE AMRITSAR-143001**

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# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-I

Sr. No.	Course Code	Subject	Periods per week		Marks		Internal Assesment*	Grand Total
			Th.	Pract.	Th.	Pract.		
1	VSC-511	Production Technology of Winter Season Vegetable Crops	4	3	75	37	38	150
2	VSC-512	Breeding of Self Pollinated and Vegetatively Propagated Vegetable Crops	4	6	75	37	38	150
3	VSC-513	Systematics of Vegetable Crops	4	3	75	37	38	150
4	TWC-514	Technical Writing and Communication Skills	2	0	50	-	-	<b>50 (NC)</b>
5	AGR-410/ PBG-410 Minor	Modern Concepts in Crop Production/ Principles of Plant Breeding	4	6	75	37	38	150
6	STA-415	Statistical Methods for Research Workers	4	3	75	37	38	150
7		Research Work (Thesis)	-	2	--	--	--	S/US
	<b>Total</b>		<b>22</b>	<b>23</b>	<b>375</b>	<b>185</b>	<b>190</b>	<b>750</b>

\*Total Internal Assessment to be given = 25% (House Test - 10%; Attendance - 10%; Conduct & Academic, Extra Curricular Activities - 5%).

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-II

Sr. No	Course Code	Subject	Periods per week		Marks		Internal Assesment*	Grand Total
			Th.	Pract.	Th.	Pract.		
1	VSC-521	Production Technology of Summer Season Vegetable Crops	4	3	75	37	38	150
2	VSC-522	Breeding of Cross Pollinated Vegetable Crops	4	6	75	37	38	150
3	VSC-523	Production Technology of Underexploited Vegetable Crops	4	3	75	37	38	150
4	VSC-524/ VST-524	Commercial Vegetable Production/Forcing Techniques in Vegetable Production	4	3	75	37	38	150
5	AGR-420/ PBG-420 Minor	Principles and Practices of Weed Management/ Breeding for Biotic and Abiotic Stress Resistance	4	6	75	37	38	150
6	STA-425	Experimental Designs for Research Worker	4	3	75	37	38	150
7		Research Work (Thesis)	--	2	--	--	--	S/US
<b>Total</b>			<b>24</b>	<b>26</b>	<b>450</b>	<b>222</b>	<b>228</b>	<b>900</b>

\*Total Internal Assessment to be given = 25% (House Test - 10%; Attendance - 10%; Conduct & Academic, Extra Curricular Activities - 5%).

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-III

Sr. No	Course Code	Subject	Periods per week		Marks		Internal Assesment*	Grand Total
			Th.	Prac	Th.	Prac		
1	VSC-531	Post-harvest Handling of Vegetable Crops	4	3	75	37	38	150
2	VSC-532	Protected Cultivation of Vegetable Crops	4	6	75	37	38	150
3	AGR-430 / PBG-430 Minor	Principles and Practices of Organic Farming/Maintenance Breeding and Concepts of Variety Release and Seed Production	4	6	75	37	38	150
4		Credit seminar	3	--	100	--	--	100
5		Research Work (Thesis)	-	2	--	--	--	S/US
<b>Total</b>			<b>15</b>	<b>17</b>	<b>325</b>	<b>111</b>	<b>114</b>	<b>550</b>

\*Total Internal Assessment to be given = 25% (House Test - 10%; Attendance - 10%; Conduct & Academic, Extra Curricular Activities - 5%).

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-IV

Sr. No.	Course Code	Subject	Periods per week		Marks		Internal Assessment*	Grand Total
			Th.	Pract.	Th.	Pract.		
1	VSC-541	Seed Production Technology of Vegetable Crops	4	3	50	25	25	100
2.	VSC-542	Organic Vegetable Production Technology	4	3	50	25	25	100
3		Research Work (Thesis)	--	4	--	--	--	S/US
		<b>Total</b>	<b>8</b>	<b>10</b>	<b>100</b>	<b>50</b>	<b>50</b>	<b>200</b>

\*Total Internal Assessment to be given = 25% (House Test - 10%; Attendance - 10%; Conduct & Academic, Extra Curricular Activities - 5%).

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-I

### VSC-511 Production Technology of Winter Season Vegetable Crops

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

**Periods per week: 04+3**

#### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) of 15 marks will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

#### **Theory:**

Introduction, nutritional value, origin, botany and taxonomy, important countries and states growing vegetables along with area, climate and soil requirements, commercial varieties/hybrids evolved by private and public sector, sowing/transplanting time, seed rate and seed treatment, nutritional and irrigation requirements, chemical weed control, mulching, physiological disorders, harvesting techniques, postharvest management, plant protection measures and seed production of:

**Section-A:** Potato and Bulb crops: onion and garlic.

**Section-B:** Cole crops: cabbage, cauliflower, knoll kohl, broccoli, brusselsprouts, chinese cabbage

**Section-C:** Root crops: carrot, radish, turnip and beetroot

**Section-D:** Peas and broad bean, green leafy cool season vegetables.

#### **Practical:**

Study of nutrient deficiency symptoms. Experiments on improved water use efficiency through mulching and different irrigation methods. Different methods of weed control and herbicide sprays. Preparation of cropping scheme for commercial farms. Quality evaluation for carotene, protein and ascorbic acid. Visit to an established vegetable farm in the region.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-I

### VSC-512 Breeding of Self Pollinated and Vegetatively Propagated Vegetable Crops.

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week: 04+6

#### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

#### **Theory:**

History of vegetable breeding. Origin, botany, taxonomy, cytogenetic, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), resistance breeding for biotic and abiotic stress, quality improvement in self-pollinated crops viz.

**Section-A:** tomato, brinjal, cowpea, pea, beans, okra, salad crops and

**Section-B:** asexually propagated crops like potato, sweet potato, colocasia and tapioca

**Section-C:** Molecular marker, marker assisted breeding and QTLs, biotechnology and their use in breeding in self pollinated and vegetatively propagated vegetable crops.

**Section-D:** Issue of patenting, PPV & FRA. Concept of ideotypes. Present status of varietal/hybrid development in India. New approaches in breeding of self pollinated vegetables.

#### **Practical:**

Selection of desirable plants from breeding population. Observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations. Induction of flowering. Selfing and crossing techniques in vegetable crops. Hybrid seed production of vegetable crops in bulk. Screening techniques for insectpests, disease and environmental stress resistance in above mentioned crops. Demonstration of sibmating and mixed population. Molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-I

VSC-513

Systematics of Vegetable Crops

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week: 04+3

### Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15)

### Theory:

**Section-A:** Principles of classification; different methods of classification; salient features of international code of nomenclature of vegetable crops.

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

**Section-C:** Cytological level of various vegetable crops; descriptive keys for important vegetables.

**Section-D:** Importance of molecular markers in evolution of vegetable crops; molecular markers as an aid in characterization and taxonomy of vegetable crops.

### Practical:

Identification, description, classification and maintenance of vegetable species and varieties; survey, collection of allied species and genera locally available; methods of preparation of herbarium and specimens.



# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-I

**TWC-514                      Technical Writing and Communication Skills**

**Time:-3 hours**

**Max. Marks: 50**  
**Theory Marks: 37**  
**Internal Assessment: 13**  
Periods per week: 02+0

### **Instructions for the Paper Setters:**

- 1) The question paper will consist of seven skill-oriented questions.
- 2) The first 6 Questions carry 5 marks each. There will be internal choice wherever possible (6x5=30 Marks).
- 3) There will be one essay type question out of two parts of the course. The student has to attempt any one of the two in about 150 words (1x7=7 Marks)

### **Course Contents:**

1. **Technical Writing**-Various forms of technical writing-theses, technical papers, reviews, electronic communication etc; qualities of technical writing; parts of research communications- title page, content page, authorship, preface, introduction, review of literature, materials and methods, experimental results, documentation; photographs and drawings with suitable captions; pagination; citations; writing of abstracts; précis; synopsis; editing and proof reading.
2. **Communication Skills**- defining communication; types of communication- verbal and non-verbal; assertive communication; using language for effective communication; paraphrasing; vocabulary building- word roots, prefixes.

### **Recommended Books:**

1. *Oxford Guide to Effective Writing and Speaking* by John Seely.
2. *The Written Word* by Vandana R Singh, Oxford University Press

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-I

**AGR-410: Modern Concepts in Crop Production (Minor)**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week: 04+3

### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### **Theory:**

**Section-A:** Crop growth analysis in relation to environment, agroecological zones of India. Quantitative agrobiological principles and inverse yield nitrogen law; Mitscherlich yield equation its interpretation and applicability; Baule unit.

**Section-B:** Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield.

**Section-C:** Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress.

**Section-D:** Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture.

### **Practical:**

Analysis of Growth & Development; leaf area index, Crop Growth rate, Relative growth rate, etc; Estimation of yield, mulching, cropping scheme, crop rotation, comparison of chemical & organic farming; Quality standards for organic farming.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-I

PBG-410

Principles of Plant Breeding (Minor)

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week: 04+06

### Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### Theory:

**Section-A:** History of plant breeding, objectives and achievements. Centres of origin, biodiversity and its significance. Plant introduction and role of plant genetic resources in plant breeding.

**Section-B:** Genetic basis of breeding self and crosspollinated crops, mating systems and response to selection. Pure line theory. Breeding methods in self, crosspollinated and asexually reproducing crops. Heterosis and inbreeding.

**Section-C:** Concept of plant ideotype. Transgressive breeding. Hybrid breeding. Self incompatibility and male sterility in crop plants and their commercial exploitation. Mutation breeding.

**Section-D:** Breeding for abiotic and biotic stresses. Testing, release and notification of varieties. Maintenance breeding. Participatory plant breeding. Plant breeder's Rights and regulations for plant variety protection and farmer's rights.

### Practical:

Floral biology of self- and cross-pollinated species. Selfing and crossing techniques. Selection methods in segregating populations and evaluation of breeding material. Maintenance of experimental records. Estimation of heterosis and inbreeding depression. Techniques in hybrid seed production using malesterility in field crops.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-I

**STA-415: Statistical Methods for Research Workers**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week: 04+3

### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### **Theory**

**Section-A:** Probability and fitting of standard frequency distribution, sampling techniques, sampling distributions, mean and standard error.

**Section-B:** Simple partial, multiple and intra class correlation and multiple regression.

**Section-C:** Tests of significance, students'-t, chi-square and large sample tests, confidence intervals.

**Section-D:** Analysis of variance for one way and two way classification with equal cell frequencies, transformation of data.

### **Practical:**

**Time: 3 Hours**

Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

**Note:** Students shall be trained to use computer to analysis the data, using available softwares. However, during university examination students will use scientific calculators to analyse the data.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-II

### VSC-521 Production Technology of Summer Season Vegetable Crops

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week: 04+3

#### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

#### **Theory:**

Introduction, nutritional value, origin, botany and taxonomy, important countries and states growing vegetables along with area, climate and soil requirements, commercial varieties/hybrids evolved by private and public sector, sowing/transplanting time, seed rate, seed treatment, nutritional and irrigation requirements, chemical weed control, mulching, physiological disorders, harvesting techniques, postharvest management, plant protection measures and seed production of warm season vegetable crops i.e.

**Section-A:** solanaceous crops, okra

**Section-B:** cucurbitaceous crops

**Section-C:** cowpea, sweet potato, cluster beans, amaranth, basella, tapioca.

**Section-D:** Polyhouse, nethouse and low tunnel technology for offseason production of summer vegetables.

#### **Practical:**

Experiments to demonstrate the role of mineral elements. Fertigation. Chemical weed control. Hybrid seed production of summer vegetables. Use of growth regulators. Seed extraction techniques. Identification of pests and diseases and their control. Forcing techniques for raising summer vegetables. Pruning, grafting and staking. Quality determination for sugar, capsaicin and minerals using atomic absorption.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-II

VSC-522

Breeding of Cross Pollinated Vegetable Crops

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week: 04+6

### Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### Theory:

History of vegetable breeding. Origin, botany, taxonomy, cytogenetic, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), quality improvement, in cross pollinated crops viz.

**Section-A:** capsicum, chilli, cucurbits (muskmelon, watermelon, cucumber, bottle gourd, longmelon, bitter gourd, sponge gourd, summer squash)

**Section-B:** Cole crops (cabbage, cauliflower, broccoli, brussel's sprouts), root crops (carrot, radish, turnip)

**Section-C:** bulb crops (onion, garlic), asparagus, leafy vegetable and spices (black pepper, turmeric, cardamom, coriander).

**Section-D:** Molecular marker, marker assisted breeding and QTLs, biotechnology and their use in breeding cross pollinated vegetable crops. Present status of varietal/hybrid development in India. New approaches in breeding of cross pollinated vegetables.

### Practical:

Selection indices in cole crops, cucurbitaceous crops, bulb crops, root crops, leafy vegetables and spices. Selfing and crossing techniques in cross pollinated vegetable crops. Biometrical analysis Line x tester analysis, North Carolina Designs, stability analysis, triple test cross analysis, generation mean analysis, diallel analysis. Estimation of heritability, heterosis and combining ability.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-II

### VSC-523      Production Technology of Underexploited Vegetables Crops

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week: 04+3

#### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

#### **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:

**Section-A:** Asparagus, artichoke and leek, brussels's sprout, chinese cabbage, broccoli, kale and artichoke.

**Section-B:** Amaranth, celery, parsley, parsnip, lettuce, rhubarb, spinach, basella, bathu (chenopods) and chekurmanis.

**Section-C:** Elephant foot yam, lima bean, winged bean, vegetable pigeon pea, jackbean and sword bean.

**Section-D:** Sweet gourd, spine gourd, pointed gourd, oriental pickling melon and little gourd (kundru).

#### **Practical:**

Identification of seeds; botanical description of plants; layout and planting; cultural practices; short term experiments of underexploited vegetables.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-II

VSC-524

Commercial Vegetable Production

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week: 04+6

### Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### Theory:

**Section-A:** Role of soil, climatic and agronomic factors in vegetable production.

**Section-B:** Principles of cultivation including direct sowing, nursery management, transplanting, hardening of seedlings and vegetable forcing.

**Section-C:** Weeds and their control. Rotation and Intercropping in vegetable crops.

**Section-D:** Export potentiality, post harvest handling, processing, storage and marketing of vegetables.

### Practical:

Sowing and transplanting of vegetable crops. Effect of soil conditions on seedling emergence and plant growth. Nutrient deficiency symptoms. Common weeds, their identification and control. Project formulation and evaluation for vegetable nursery production and vegetable forcing techniques.



# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-II

VST-524

Forcing Techniques in Vegetable Production

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week: 04+6

### Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### Theory:

**Section-A:** Objectives, importance and scope of protected cultivation. Nursery raising techniques. environmental factors. Vegetable growing media. Irrigation and fertigation.

**Section-B:** Sustainable land use systems. Maximising land use efficiency in protected structures. Problems of growing vegetables in protected structures.

**Section-C:** Soil sterilization techniques. Hydroponics cultivation. Pest management in green house/glass house. Crops and varieties suitable for protected cultivation.

**Section-D:** Specific technology for raising tomato, sweet pepper, cucumber and high value crops in off season. Cladding material for protected structures use of mulches. Seed production of vegetables.

### Practical:

Study of various types of structures. Methods to control temperature, CO<sub>2</sub>, light. demonstration for sanitation measures. Hydroponics. Maintenance of parental lines and hybrid seed production in glasshouse. Fertigation and nutrient management. Control of diseases and insect pests in glasshouse. Visit to established greenhouses in the region.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-II

**AGR-420: Principles and Practices of Weed Management (Minor)**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week: 04+6

### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### **Theory:**

**Section-A:** Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices.

**Section-B:** Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides.

**Section-C:** Herbicide structure activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures; herbicide resistance and management; weed control through bioherbicides, mycoherbicides and allelochemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation.

**Section-D:** Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control. Integrated weed management; cost : benefit analysis of weed management.

### **Practical:**

Identification of important weeds of different crops; preparation of a weed herbarium; weed survey in crops and cropping systems; crop-weed competition studies; preparation of spray solutions of herbicides of high and low volume sprayers; use of various types of spray pumps and nozzles and calculation of swath width; economics of weed control; herbicide residue analysis in plant and soil; bioassay of herbicide residue; calculation of herbicidal requirement.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-II

**PBG-420 Breeding for Biotic and Abiotic Stress Resistance (Minor)**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week: 04+6

### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### **Theory:**

**Section-A:** Plant breeding with reference to biotic and abiotic stress resistance. Biotic stresses in economically important crops. Host defense responses to pathogen invasions. Biochemical and molecular mechanisms. Host-pathogen interactions.

**Section-B:** Gene-for-gene hypothesis. Acquired and induced immunity. Systemic acquired resistance (SAR). Concept of signal transduction and other host defense mechanisms against viruses and bacteria. Types and genetic mechanisms of resistance to biotic stresses. Phenotypic screening methods for major pests and diseases.

**Section-C:** Gene pyramiding. Classification of abiotic stresses moisture stress/drought, water logging and submergence, wind, acidity, salinity/alkalinity/sodicity, temperature etc. Stress due to soil factors and mineral toxicity. Physiological and phenological responses. Genetics of abiotic stress resistance.

**Section-D:** Genes and genomics in breeding for abiotic stresses. Utilizing MAS procedures. Breeding for resistance to abiotic stresses. Exploitation of wild relatives as a source of resistance to biotic and abiotic factors in major field crops. Transgenics in management of biotic and abiotic stresses.

### **Practical:**

Phenotypic screening techniques for sucking pests, chewing pests, nematodes and borers. Use of standard MAS procedures. Phenotypic screening methods for diseases caused by fungi and bacteria. Screening crops for drought, flood resistance, acidity, alkalinity and temperature etc.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-II

**STA-425: Experimental Designs for Research Workers**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week: 04+3

### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### **Theory:**

**Section-A:** Need for designing of experiments- characteristics of a good design, basic principles- randomization, replication and local control, uniformity trials- size and shape of plots and blocks, analysis of variance and interpretation of data.

**Section-B:** Completely randomized, randomized block and latin square design, multiple comparison tests, factorial experiments- interpretation of main effects and interactions,

**Section-C:** Orthogonality and partitioning of degrees of freedom confounding in  $2^3$ ,  $2^4$  and  $3^3$  designs, split and strip plot designs, crossover designs and balanced incomplete block designs, response surface designs, switch over trials and long term experiments;

**Section-D:** Selection of experimental design, mechanical errors in field experiments and methods of reducing it, presentation of research results.

### **Practical:**

Uniformity trials, completely randomized, randomized block and latin square designs, missing plot and analysis, of covariance,  $2^3$ ,  $2^4$  and  $3^3$  simple and confounded experiments, split and strip plot designs, cross over Uniformity trials, completely randomized, randomized block and latin square designs, missing plot and analysis, of covariance,  $2^3$ ,  $2^4$  and  $3^3$  simple and confounded experiments, split and strip plot designs, cross over and balanced incomplete block designs.

**Note:** Students shall be trained to use computer to analysis the data, using available softwares.

However, during university examination students are allowed to use scientific calculators to analysis is the data.

**Note:** Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-III

VSC-531

Post-harvest Handling of Vegetable Crops

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week: 04+3

### Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### Theory:

**Section-A:** Determination of maturity in different vegetable crops, assessment of post harvest losses, pre harvest methods and practices effecting post harvest shelf life of vegetables.

**Section-B:** Mechanized harvesting of vegetables, pre cooling of vegetables using different techniques, post harvest chemical and non chemical treatments to enhance shelf life, sorting and grading for packaging.

**Section-C:** Ripening of vegetables, packaging of vegetables including latest techniques like MAP, storage of vegetables including latest techniques like CA storage, food safety and quality, non destructive methods of quality analysis,

**Section-D:** Quality of raw material for processing, transportation and destination handling, marketing, treatments before shipment and storage, fresh cut vegetables.

### Practical:

Practices in judging the maturity of vegetables, harvesting methods and tools. Methods used for pre cooling and their efficiency measurements. Post harvest chemical treatments to extend shelf life. Sorting and grading methods. Ripening techniques used in climacteric vegetables. Traditional and latest safe storage techniques. Respiration measurements in harvested produce. Field visit to postharvest and processing industry.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-III

VSC-532

Protected Cultivation of Vegetable Crops

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week: 04+6

### Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### Theory:

**Section-A:** Importance and scope of protected cultivation of vegetable crops; principles used in protected cultivation, energy management, low cost structures; training methods; engineering aspects.

**Section-B:** Regulatory structures used in protected structures; types of greenhouse/polyhouse/nethouse, hot beds, cold frames, effect of environmental factors, viz. temperature, light, CO<sub>2</sub> and humidity on growth of different vegetables, manipulation of CO<sub>2</sub>, light and temperature for vegetable production, fertigation. Regulation of flowering and fruiting in vegetable crops

**Section-C:** Nursery raising in protected structures like poly tunnels, types of benches and containers, different media for growing nursery under cover. Soil less culture, use of protected structures for seed production. Problem of growing vegetables in protected structures and their remedies, insect and disease management in protected structures;

**Section-D:** Technology for raising tomato, sweet pepper, cucumber, melons and lettuce and other vegetables in protected structures, training and staking in protected crops, varieties and hybrids for growing vegetables in protected structures.

### Practical:

Study of various types of structures, methods to control temperature, CO<sub>2</sub> light, media, training and pruning, maintenance of parental lines and hybrid seed production of vegetables, 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.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-III

**AGR-430: Principles and Practices of Organic Farming (Minor)**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

**Periods per week: 04+3**

### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### **Theory:**

**Section-A:** Organic farming - concept and definition, its relevance to India and global agriculture and future prospects;

**Section-B:** land and water management - land use, minimum tillage; shelter zones, hedges, pasture management, agro forestry. Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers.

**Section-C:** Farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity. Control of weeds, diseases and insect pest management, biological agents and pheromones, biopesticides.

**Section-D:** Socio economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.

### **Practical:**

Aerobic and anaerobic methods of making compost; making of vermicompost; identification and nursery raising of important agro forestry trees and trees for shelter belts; efficient use of biofertilizers, technique of treating legume seeds with rhizobium cultures, use of azotobacter, azospirillum, and PSB cultures in field; visit to an organic farm; quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-III

PBG-430

Maintenance Breeding Seed Production (Minor)

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week: 04+3

### Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (15).

### Theory:

**Section-A:** Variety development and maintenance. Defining variety, cultivar, extant variety, derived variety, reference variety, farmer's variety, hybrid and population.

**Section-B:** Variety testing, release and notification systems in India and abroad. US testing. Genetic deterioration of varieties.

**Section-C:** Maintenance of varieties. Principles of seed production. Generation system of seed multiplication. Quality seed production of cereals and millets, pulses, oilseeds, cotton and forages.

**Section-D:** Seed certification. Seed laws and plant variety protection regulations in India and international systems.

### Practical:

Identification of suitable areas for seed production. Ear-to-row method and nucleus seed production. Main characteristics of released and notified varieties, hybrids and parental lines. Identification of important weeds/objectable weeds. Determination of isolation distance and planting ratios in different crops. Seed production techniques of varieties in different crops. Hybrid seed production technology of important crops.



# **M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)**

## **SEMESTER-III**

### **CREDIT SEMINAR**

**Total Marks: 100**

**Periods per week: 03**

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-IV

**VSC-541**                      **Seed Production Technology of Vegetable Crops**

**Time: 3 Hours**

**Max. Marks: 100**

**Theory: 50**

**Practical: 25**

**Internal assessment: 25**

**Periods per week: 4+3**

### **Instructions for the Paper Setters:**

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (10).

### **Theory:**

**Section-A:** Definition of seed and its quality; DUS test, scope of vegetable seed industry in India.

**Section-B:** Agronomical principles and methods of seed production in important vegetable crops; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production.

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

**Section-D:** 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.

### **Practical:**

Seed sampling, seed testing (genetic purity, seed viability, seedling vigour, germination, physical purity) and seed health testing. Notification procedures of varieties. Floral biology. Rouging offtypes. Methods of hybrid seed production in important vegetable crops. Seed extraction techniques. Handling of seed processing and seed testing equipments. Visit to seed processing units. Seed testing laboratory and seed production farms.

# M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)

## SEMESTER-IV

VSC-542

Organic Vegetable Production Technology

Time: 3 Hours

Max. Marks: 100

Theory: 50

Practical: 25

Internal assessment: 25

Periods per week: 04+3

### Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (10).

### Theory:

**Section-A:** Importance, principles, perspective, concept and component of organic production of vegetable crops. Managing soil fertility, pests and diseases and weed problems in organic farming system.

**Section-B:** Crop rotation in organic vegetable production; processing and quality control for organic foods. Methods for enhancing soil fertility, mulching, raising green manure crops. Indigenous methods of compost, Panchgavya, Biodynamics preparation etc.

**Section-C:** Pest and disease management in organic farming; ITK's inorganic farming, role of botanicals and bio-control agents. GAP and GMP Certification or organic products; organic production and export opportunity and challenges.

**Section-D:** Organic production of vegetables crops, viz. solanaceous crops, cucurbits, cole crops, root and tuber crops.

### Practical:

Method of preparation of compost, vermin composting, biofertilizers, soil solarization, bio pesticides in horticulture, green manuring, mycorrhizae and organic crop production, waster management, organic soil amendment for root disease, weed management in organic horticulture. Visit to organic fields and marketing centers.

**M.Sc. Ag. HORTICULTURE (VEGETABLE SCIENCE)**

**SEMESTER-IV**

**RESEARCH WORK**

**Total Marks: S/US**

**Periods per week: 04**