

GURU KASHI UNIVERSITY



Master of Science in Agriculture (Vegetable Science) (VSC)

Session: 2026-27

Faculty of Agriculture

Graduate Attributes of the Programme: -

Type of learning outcomes	The Learning Outcomes Descriptors
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/interdisciplinary areas of learning	The students will know about the packages of practices of warm season, winter season and underexploited vegetable crops. The students will know about the breeding programmes, morphological, evolution, classification of vegetable crops.
Generic learning outcomes	To prepare graduates to be skilled professionals and innovators in the field of horticulture. They gain a robust blend of theoretical knowledge, practical expertise, research capabilities, and professional skills, enabling them to contribute to sustainable agriculture, food security, and agribusiness.

Programme Learning outcomes:

A Postgraduate Certificate is awarded to students who have demonstrated the achievement of the outcomes located at level 6.0:

Element of the Descriptor	Programme learning outcomes relating to Undergraduate Certificate
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Learn about the packages of practices of warm season, cool season and organic production of vegetables.
General, technical and professional skills required to perform and accomplish tasks	Educate about principles and practices adopted for breeding of Self- and cross pollinated vegetable crops and familiar with principles and practices of processing of vegetable crops
Application of knowledge and skills	Establish specific plant breeding activities, such as election of parental germplasm, observation and recording of phenotypic variation and selection among progeny
Generic learning outcomes	Inculcate knowledge about morphological, cytological and molecular taxonomy of Vegetable crops and their evolution.
Constitutional, humanistic, ethical, and moral values	Acquire practical exposure with package and practices of underexploited vegetables so as to enhance production for farmers and community.
Employability and	Provides a strong foundation for both employability and entrepreneurship.

job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Graduates are equipped with technical expertise, research skills, and practical experience to excel in roles across government, private, and research sectors. Simultaneously, the program fosters an entrepreneurial mindset, enabling graduates to launch innovative ventures in vegetable production, organic farming, or agri-tech.																		
Credit requirements	<table border="1"> <thead> <tr> <th colspan="2">Masters' Programme</th> </tr> </thead> <tbody> <tr> <td colspan="2">(i) Course work</td> </tr> <tr> <td>Major courses</td><td>20</td> </tr> <tr> <td>Minor courses</td><td>08</td> </tr> <tr> <td>Supporting courses</td><td>06</td> </tr> <tr> <td>Common courses</td><td>05</td> </tr> <tr> <td>Seminar</td><td>01</td> </tr> <tr> <td>(ii) Thesis Research</td><td>30</td> </tr> <tr> <td>Total</td><td>70</td> </tr> </tbody> </table>	Masters' Programme		(i) Course work		Major courses	20	Minor courses	08	Supporting courses	06	Common courses	05	Seminar	01	(ii) Thesis Research	30	Total	70
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Seminar	01																		
(ii) Thesis Research	30																		
Total	70																		
Entry requirements	A student with a Bachelor Degree subject to fulfillment of the eligibility conditions of a programme as specified by the University, shall be eligible for admission to a 2-year PG Programme.																		

Program structure of the M.Sc. Vegetable Science

SEMESTER I									
Course Code	Course Title	Type of Course	L	T	P	No. of Credits	Int.	Ext.	Total marks
VSC501	Production of Cool Season Vegetables Crops	Major	2	0	0	2	30	70	100
VSC502	Production of Cool Season Vegetables Crops Lab	Major	0	0	2	1	30	70	100
VSC503	Protected Cultivation of Vegetable Crops	Major	1	0	0	1	30	70	100
VSC504	Protected Cultivation of Vegetable Crops Lab	Major	0	0	2	1	30	70	100
FSC507	Tropical Fruit Production	Minor (CBCS) Choose any one	2	0	0	2	30	70	100
FLS501	Commercial Production of Cut Flowers								
FSC508	Tropical Fruit Production Lab	Minor (CBCS) Choose any one	0	0	2	1	30	70	100
FLS502	Commercial Production of Cut Flowers Lab								
STAT501	Agriculture Statistics	Supporting	3	0	0	3	30	70	100
STAT502	Agriculture Statistics Lab	Supporting	0	0	2	1	30	70	100
PGC501	Library and Information Services Lab	Common	0	0	2	1	30	70	100
PGC502	Agricultural Research, Research Ethics and Rural Development Programmes	Common	1	0	0	1	30	70	100
VSC600	Master Research	Research	-	-	-	2	S/US	S/US	S/US
Total						16			

SEMESTER II									
Course Code	Course Title	Type of Course	L	T	P	No. of Credits	Int.	Ext.	Total marks
VSC505	Production Technology of warm Season Vegetable Crops	Major	2	0	0	2	30	70	100
VSC506	Production Technology of warm Season Vegetable Crops Lab	Major	0	0	2	1	30	70	100
VSC507	Breeding of Cross Pollinated Vegetable Crops	Major	2	0	0	2	30	70	100
VSC508	Breeding of Cross Pollinated Vegetable Crops Lab	Major	0	0	2	1	30	70	100
VSC509	Postharvest Management of Vegetable Crops	Major	1	0	0	1	30	70	100
VSC510	Postharvest Management of Vegetable Crops Lab	Major	0	0	2	1	30	70	100
FSC501	Sub-Tropical and Temperate Fruit Production	Minor (CBCS) Choose any one	2	0	0	2	30	70	100
FLS507	Commercial Production of Loose Flowers								
FSC502	Sub-Tropical and Temperate Fruit Production Lab	Minor (CBCS) Choose any one	0	0	2	1	30	70	100
FLS508	Commercial Production of Loose Flowers Lab								
VSC557	Seminar	Seminar	-	-	-	1	30	70	100
CA551	Fundamentals of Computer Applications Lab	Supporting	0	0	4	2	30	70	100
PGC551	Basic Concepts in Laboratory Techniques-Lab	Common	0	0	2	1	30	70	100
VSC600	Master Research	Research	-	-	-	5	S/US	S/US	S/US
Total						20			

SEMESTER III									
Course Code	Course Title	Type of Course	L	T	P	No. of Credits	Int.	Ext.	Total marks
VSC511	Breeding of Self Pollinated and Vegetative Propagated Vegetable Crops	Major	2	0	0	2	30	70	100
VSC512	Breeding of Self Pollinated and Vegetative Propagated Vegetable Crops Lab	Major	0	0	2	1	30	70	100
VSC513	Organic Vegetable Production	Minor	1	0	0	1	30	70	100
VSC514	Organic Vegetable Production Lab	Minor	0	0	2	1	30	70	100
PGC504	Technical Writing and Communication Skills Lab	Common	0	0	2	1	30	70	100
VSC600	Master Research	Research	-	-	-	10	S/US	S/US	S/US
Total						16			

SEMESTER-IV									
Course Code	Course Title	Type of Course	L	T	P	No. of Credits	Int.	Ext.	Total marks
VSC515	Growth and Development of Vegetable Crops	Major	1	0	0	1	30	70	100
VSC516	Growth and Development Lab of Vegetable Crops Lab	Major	0	0	2	1	30	70	100
VSC517	Seed Production of Vegetable Crops	Major	1	0	0	1	30	70	100
VSC518	Seed Production of Vegetable Crops Lab	Major	0	0	2	1	30	70	100
PGC505	Intellectual Property and its management in Agriculture	Common	1	0	0	1	30	70	100
VSC600	Master Research	Research	-	-	-	13	S/US	S/US	S/US
Total						18			
Grand Total						70			

CBCS (Choice Based Credit System)

Semester I

Course Title: Production of Cool Season Vegetable Crops	L	T	P	Credits
Course Code: VSC501	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Acquaint with winter vegetable crops growing in a vegetable garden.
2. Distinguish about cultural practices and identification concepts.
3. Know about the preparation of land for cultivation of vegetable crops.
4. Impart special horticultural practices, weed control, mulching, role of plant growth regulators.

Theory Content

Unit I

7 Hours

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery, sowing/planting time and precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-

harvest management (grading, packaging and marketing), pest and disease management and production economics of crops.

Bulb and tuber crops—Onion, garlic and potato.

Unit II

7 Hours

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery, sowing/planting time and precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post- harvest management (grading, packaging and marketing), pest and disease management and production economics of crops.

Root crops—Carrot, radish, turnip and beetroot.

Unit III

8 Hours

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery, sowing/planting time and precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post- harvest management (grading, packaging and marketing), pest and disease management and production economics of crops.

Cole crops—Cabbage, cauliflower, kohlrabi, broccoli, Brussels sprouts and kale

Unit IV**8 Hours**

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, sowing/ planting time and precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of crops.

Peas and beans—Garden peas and broad bean.

Leafy vegetables—Beet leaf, fenugreek, coriander and lettuce.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Cooperative Learning, Classroom lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures.

Suggested Readings

- *Hazra P and Banerjee MK and Chattopadhyay A. 2012. Varieties of vegetable crops in India, (Second edition), Kalyani publishers, Ludhiana, 199 p.*
- *Hazra P. 2016. Vegetable Science. 2nd edn, Kalyani publishers, Ludhiana.*
- *Hazra P. 2019. Vegetable production and technology. New India publishing agency, New Delhi.*
- *Hazra P, Chattopadhyay A, Karmakar K and Dutta S. 2011. Modern technology for vegetable production, New India publishing agency, New Delhi, 413p*
- *Rana MK. 2008. Olericulture in India. Kalyani publishers, New Delhi.*

- *Rana MK. 2008. Scientific cultivation of vegetables. Kalyani publishers, New Delhi.*
- *Rana MK. 2014. Technology for vegetable production. Kalyani publishers, New Delhi.*
- *Rubatzky VE and Yamaguchi M. (Eds.). 1997. World vegetables: principles, production and nutritive values. Chapman and Hall.*
- *Singh DK. 2007. Modern vegetable varieties and production technology. International book distributing Co.*

Selected Journals list for reading:

- American Potato Growers California Agriculture
- Haryana Journal of Horticultural Sciences

Course Title: Lab-Production of Cool Season Vegetable Crops	L	T	P	Credits
Course Code: VSC502	0	0	2	1

Practical Content**Total Hours: 15**

1. Scientific raising of nursery and seed treatment
2. Sowing and transplanting.
3. Description of commercial varieties and hybrids.
4. Demonstration on methods of irrigation, fertilizers and micronutrients application.
5. Mulching practices, weed management.
6. Use of plant growth substances in cool season vegetable crops.
7. Study of nutritional and physiological disorders.
8. Identification of important pest and diseases and their controls.
9. Preparation of cropping scheme for commercial farms.
10. Visit to vegetable market.
11. Analysis of benefit to cost ratio.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Cooperative Learning, Classroom lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures.

Suggested Readings

- *Hazra P and Banerjee MK and Chattopadhyay A. 2012. Varieties of vegetable crops in India, (Second edition), Kalyani publishers, Ludhiana, 199 p.*
- *Hazra P. 2016. Vegetable Science. 2nd edn, Kalyani publishers, Ludhiana.*
- *Hazra P. 2019. Vegetable production and technology. New India publishing agency, New Delhi.*

- *Hazra P, Chattopadhyay A, Karmakar K and Dutta S. 2011. Modern technology for vegetable production, New India publishing agency, New Delhi, 413p*
- *Rana MK. 2008. Olericulture in India. Kalyani publishers, New Delhi.*
- *Rana MK. 2008. Scientific cultivation of vegetables. Kalyani publishers, New Delhi.*
- *Rana MK. 2014. Technology for vegetable production. Kalyani publishers, New Delhi.*
- *Rubatzky VE and Yamaguchi M. (Eds.). 1997. World vegetables: principles, production and nutritive values. Chapman and Hall.*
- *Singh DK. 2007. Modern vegetable varieties and production technology. International book distributing Co.*

Course Title: Protected Cultivation of Vegetable Crops	L	T	P	Credits
Course Code: VSC503	1	0	0	1

Total Hours: 15

Learning outcome: After completion of this course, the learner will be able to:

1. Understand the scope and scenario of protected cultivation of vegetable crops in India.
2. Acquire knowledge about the effect of abiotic factors on growth, flowering and production of vegetable crops.
3. Gain knowledge about the designing of various low cost protected structures.
4. Adopt the methods of raising of vegetable seedlings in low cost protected structures as entrepreneur.

Theory Content

Unit I

2 Hours

Concept, scope and importance of protected cultivation of vegetable crops; Principles, design, orientation of structure, low and high cost polyhouses/greenhouse structures.

Unit II

4 Hours

Types of protected structure-classification and types of protected structures greenhouse/ polyhouses, plastic-non plastic low tunnels, plastic walk in tunnels, high roof tunnels with ventilation, insect proof net houses, shed net houses, rain shelters, naturally ventilated polyhouse, climate control greenhouses, hydroponics and aeroponics; Soil and soilless media for bed preparation; design and installation of drip irrigation and fertigation system.

Unit III

4 Hours

Abiotic factors- Effect of environmental factors and manipulation of temperature, light, carbon dioxide, humidity, etc. on growth and yield of different vegetables.

Unit IV

5 Hours

Nursery raising- High tech vegetable nursery raising in protected structures using plugs and portrays, different media for growing nursery under protected cultivation; Nursery problems and management technologies including fertigation.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Cooperative Learning, Classroom lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures.

Suggested Reading

- *Chadha KL and Kalloo G. (Eds.). 1993-94. Advances in horticulture. Malhotra Pub. House.*
- *Chandra S and Som V. 2000. Cultivating vegetables in green house. Indian Horticulture 45:17- 18.*
- *Kalloo G and Singh K. (Eds.). 2000. Emerging scenario in vegetable research and development. Research Periodicals and Book Publication House.*
- *Parvatha RP. 2016. Sustainable crop protection under protected cultivation. E-Book Springer.*
- *Prasad S and Kumar U. 2005. Greenhouse management for horticultural crops. 2nd Ed. Agrobios.*
- *Resh HM. 2012. Hydroponic food production. 7thEdn. CRC Press.*
- *Singh B. 2005. Protected cultivation of vegetable crops. Kalyani Publishers, New Delhi*
- *Singh DK and Peter KV. 2014. Protected cultivation of horticultural crops (1st Edition) New India Publishing Agency, New Delhi.*

Selected Journals list for reading

- Horticulture Research
- Hort Science
- IIVR Bulletins

Course Title: Lab-Protected Cultivation of Vegetable Crops	L	T	P	Credits
Course Code: VSC504	0	0	2	1

Practical Content**Total Hours: 15**

1. Study of various types of protected structure.
2. Study of different methods to control temperature, carbon dioxide and light.
3. Study of different types of growing media, training and pruning systems in greenhouse crops.
4. Study of fertigation and nutrient management under protected structures.
5. Study of insect pests and diseases in greenhouse and its control.
6. Use of protected structures in hybrid seed production of vegetables.
7. Economics of protected cultivation (Any one crop).
8. Visit to established green/ polyhouses/shade net houses in the region.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Cooperative Learning, Classroom lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures.

Suggested Reading

- *Chadha KL and Kalloo G. (Eds.). 1993-94. Advances in horticulture. Malhotra Pub. House.*
- *Chandra S and Som V. 2000. Cultivating vegetables in green house. Indian Horticulture 45:17- 18.*

- *Kalloor G and Singh K. (Eds.). 2000. Emerging scenario in vegetable research and development. Research Periodicals and Book Publication House.*
- *Parvatha RP. 2016. Sustainable crop protection under protected cultivation. E-Book Springer.*
- *Prasad S and Kumar U. 2005. Greenhouse management for horticultural crops. 2nd Ed. Agrobios.*
- *Resh HM. 2012. Hydroponic food production. 7thEdn. CRC Press.*
- *Singh B. 2005. Protected cultivation of vegetable crops. Kalyani Publishers, New Delhi*
- *Singh DK and Peter KV. 2014. Protected cultivation of horticultural crops (1st Edition) New India Publishing Agency, New Delhi.*

Selected Journals list for reading

- Horticulture Research
- Hort Science
- IIVR Bulletins

Course Title: Tropical Fruit Production	L	T	P	Credits
Course Code: FSC507	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to

- 1 Equip themselves with know-how on agro-techniques for establishment and management of an orchard leading to optimum and quality fruit production of tropical fruits.
- 2 Learn the importance and identification of different agri export zone for fruit crops.
- 3 Study the importance of flowering, pollination, fruit set and fruiting, harvesting and physiology of tropical fruit crops.
- 4 Design the strategy storage marketing, post-harvest technology with knowhow of export and industrial potential.

Theory content

Importance, origin and distribution, major species, rootstocks and commercial varieties of regional, national and international importance, eco-physiological requirements. Propagation, planting and orchard floor management: Asexual and sexual methods of propagation, planting systems and planting densities, training and pruning methods, rejuvenation, intercropping, nutrient management, water management, fertigation, use of bio-fertilizers, role of bio regulators, abiotic factors limiting fruit production. Flowering, fruit-set and harvesting: Physiology of flowering, pollination management, fruit set and development, physiological disorders – causes and remedies, crop regulation, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; insect and disease management.

Unit I **8 hours**

Fruit crops - Citrus, mango, papaya, pineapple.

Unit II **7 hours**

Fruit crops - Banana, avocado, sapota, guava.

Unit III **7 hours**

Fruit crops - Ber, amla, jack fruit, annonas.

Unit IV **8 hours**

Fruit crops - Minor Tropical Fruit crops.

Course Title: Lab-Tropical Fruit Production	L	T	P	Credits
Course Code: FSC508	0	0	2	1

Practical content**Total Hours: 15**

1. Distinguished features of tropical fruit species, cultivars and rootstocks.
2. Demonstration of planting systems, training and pruning.
3. Hands on practices on pollination and crop regulation.
4. Leaf sampling and nutrient analysis.
5. Physiological disorders-malady diagnosis.
6. Physico-chemical analysis of fruit quality attributes.
7. Field/exposure visits to tropical orchards.
8. Project preparation for establishing commercial orchards.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Bose TK, Mitra SK and Sanyal D. 2002. *Fruits of India – Tropical and Sub-Tropical*. 3rd Edn. Naya Udyog, Kolkata.
- Dhillon WS. 2013. *Fruit Production in India*. Narendra Publication House, New Delhi.
- Litz RE. 2009. *The Mango: Botany, Production and Uses*. CAB International.
- Madhawa Rao VN. 2013. *Banana*. ICAR, New Delhi. Midmore D. 2015. *Principles of Tropical Horticulture*. CAB International.
- Mitra SK and Sanyal D. 2013. *Guava*, ICAR, New Delhi. Morton JF. 2013. *Fruits of Warm Climates*. Echo Point Book Media, USA.

Course Title: Commercial Production of Cut Flowers	L	T	P	Credits
Course Code: FLS501	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Recall understanding of production and post-harvest management of flower crops.
2. Acquire the required skills to prepare project reports on different crops for financing.
3. Prioritize the preparation of land for cultivation of cut flower crops
4. Gain knowledge about innovative nursery raising technique for cut flower crops for raising quality and disease-free seedlings.

Theory Content

National and International scenario, importance and scope of cut flower trade, constraints for cut flower production in India. Growing environment: Soil analysis, soil health card, growing environment, open cultivation, protected cultivation, soil/media requirements, land preparation, planting methods, influence of light, temperature, moisture, humidity and microclimate management on growth and flowering. Crop management: Commercial flower production – Commercial varieties, water and nutrient management, fertigation, weed management, crop specific practices, ratooning, training and pruning, pinching, deshooting, bending, desuckering, disbudding. Use of growth regulators, physiological disorders and remedies, IPM and IDM. Flower regulation: Flower forcing and year round/offseason flower production through physiological interventions, chemical regulation, environmental manipulation.

Total Hours: 30**Unit I 8 Hours**

Flower crops - Rose, chrysanthemum, gladiolus, tuberose, carnation.

Unit II 7 Hours

Flower crops - Gerbera, orchids, liliun, anthurium, china aster.

Unit III 7 Hours

Flower crops - Alstroemeria, bird of paradise, heliconia, alpinia, ornamental ginger.

Unit IV 8 Hours

Flower crops - Dahlia, gypsophila, solidago, limonium, stock, cut greens and fillers.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings

- *Arora JS. 2010. Introductory Ornamental Horticulture. Kalyani Publishers. 6th edition, pp. 230.*
- *Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.*
- *Bose TK, Maiti, RG, Dhua RS and Das P. 1999. Floriculture and Landscaping. Prokash, Kolkata, India.*
- *Bose TK and Yadav LP. 1989. Commercial Flowers. Naya Prokash, Kolkata, India.*
- *Chadha KL and Bhattacharjee SK. 1995. Advances in*

Horticulture: Ornamental Plants. Vol. XII, Parts 1 & 2. pp. 533, pp. 574. Malhotra Publ. House, New Delhi, India.

- *Reddy S, Janakiram T, Balaji Kulkarni S and Misra RL. 2007. Hi-Tech Floriculture. Indian Society of Ornamental Horticulture, New Delhi, India.*
- *Singh AK. 2006. Flower Crops: Cultivation and Management. New India Publ. Agency, New Delhi, India. pp. 475.*

Selected Journals list for reading

- Indian Journal of Horticulture
- Journal of American Society for Horticultural Sciences

Course Title: Lab-Commercial Production of Cut Flowers	L	T	P	Credits
Course Code: FLS502	0	0	2	1

Practical Content**Total Hours: 15**

1. Identification of varieties.
2. Propagation.
3. Microclimate management.
4. Training and pruning techniques
5. Pinching, deshooting, disbudding, desuckering.
6. Practices in manuring, drip and fertigation, foliar nutrition, growth regulator application, harvesting techniques, post-harvest handling, cold chain.
7. No Blocks Units Horticultural Sciences–Floriculture and landscaping.
8. Economics, Project preparation for regionally important cut flowers, crop specific guidelines for project financing (NHB guidelines).
9. Visit to commercial cut flower units.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings

- *Arora JS. 2010. Introductory Ornamental Horticulture. Kalyani Publishers. 6th edition, pp. 230.*
- *Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.*

- *Bose TK, Maiti, RG, Dhua RS and Das P. 1999. Floriculture and Landscaping. Prokash, Kolkata, India.*
- *Bose TK and Yadav LP. 1989. Commercial Flowers. Naya Prokash, Kolkata, India.*
- *Chadha KL and Bhattacharjee SK. 1995. Advances in Horticulture: Ornamental Plants. Vol. XII, Parts 1 & 2. pp. 533, pp. 574. Malhotra Publ. House, New Delhi, India.*
- *Reddy S, Janakiram T, Balaji Kulkarni S and Misra RL. 2007. Hi-Tech Floriculture. Indian Society of Ornamental Horticulture, New Delhi, India.*
- *Singh AK. 2006. Flower Crops: Cultivation and Management. New India Publ. Agency, New Delhi, India. pp. 475*

Course Title: Agricultural Statistics	L	T	P	Credits
Course Code: STAT501	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will
be able to:

- 1 Study about statistical principles apply in all the areas of experimental work.
- 2 Understand the requirement at the national level and farm level for agriculture policy making,
3. Study the importance of statistics in agriculture, helps to ascertain the volume of crop that needs to be produced based on output and demand of previous year
4. Acquire knowledge about land utilization and irrigation including the net area sown gross cultivated area, current follow, cultivable waste.

Theory Content

Unit-1 **15Hr**

Frequency distribution, standard error and deviation, correlation and regression analyses, co- efficient of variation.

Unit-2 **10Hr**

Hypothesis testing. Concept of p-value. Tests of significance-t, F and chi square (X²).

Unit-3**10Hr**

Data transformation and missing plot techniques; Design of experiments and their basic principles, completely randomized, randomized block, split plot, strip-plot, factorial and simple confounding designs

Unit-4**10Hr**

Efficiency of designs; Methods of statistical analysis for cropping systems including intercropping; Pooled analysis.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Panse, V.G. and Sukhatme, P.V. 1954. Statistical methods for agricultural workers. pp. 361.*
- *Gupta, S.C. and Kapoor, V.K. 2014. Fundamentals of Mathematical Statistics.*
- *Sultan Chand & Sons, New Delhi. pp. 230.*
- *Snecdecor, G.W. and Cochran, W.G. 1989. Statistical Methods, 8th Edition. Wiley-Blackwell. Pp.524.*
- *Rangaswamy, R. 2016. Textbook of Agricultural Statistics. New Age International (P) Ltd. New Delhi. pp. 531.*

Course Title: Lab-Agricultural Statistics	L	T	P	Credits
Course Code: STAT502	0	0	2	1

Practical Content**Total Hours: 30**

1. Correlation analysis.
2. Regression analysis (exponential, power function, quadratic, multi-variate, selection of variables, validation of models, ANOVA and testing of hypothesis).
3. Tests of significance (Z-test, t-test, F-test and Chi-square test).
4. Analysis of variance.
5. Completely randomized design.
6. Randomized block designs.
7. Latin square designs.
8. Missing plot and analysis of covariance. 23, 24 and 33 simple and confounded experiments. Split plot designs.
9. Factorial in split plot designs.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Panse, V.G. and Sukhatme, P.V. 1954. Statistical methods for agricultural workers. pp. 361.*
- *Gupta, S.C. and Kapoor, V.K. 2014. Fundamentals of Mathematical Statistics.*
- *Sultan Chand & Sons, New Delhi. pp. 230.*
- *Snecdecor, G.W. and Cochran, W.G. 1989. Statistical Methods, 8th Edition. Wiley-Blackwell. Pp.524.*
- *Rangaswamy, R. 2016. Textbook of Agricultural Statistics. New Age International(P) Ltd. New Delhi. pp. 531.*

Course Title: Lab-Library and Information Services	L	T	P	Credits
Course Code: PGC501	0	0	4	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Identify library services and availability of resources in order to develop a realistic overall plan for research
- 2 Use general information resources to increase familiarity with the topic and disciplinary vocabulary
- 3 Learn about the research topic, question or thesis to achieve a manageable focus appropriate to the assignment criteria, available resources, and evidence needed to support thesis
- 4 Effectively search information resources.

Practical Content

1. Introduction to Library and its services
2. Five laws of library science; type of documents; classification and cataloguing; organization of documents; sources of information primary, secondary and tertiary.
3. Current awareness and SDI services
4. Tracing information from reference sources
5. Library survey; preparation of bibliography.
6. Use of Online Public Access Catalogue
7. Use of CD-ROM databases and other computerized library services, CeRA, J- Gate.
8. Use of Internet including search engines and its resources; e-resources.

Course Title: Agricultural Research, Research Ethics and Rural Development Programmes
Course Code: PGC502

L	T	P	C
1	0	0	1

Total Hours-15

Course Outcomes: After successful completion of this course, the students will be able to:

1. To enlighten the students about the organization and functioning of agricultural research systems at national and international levels
2. To aware the students about research ethics, and rural development programmes and policies of Government
3. Acquire knowledge on Concept and connotations of rural development
4. Constraints in implementation of rural policies and programmes

UNIT-I

3-Hours

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):

UNIT-II

4-Hours

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

UNIT-III

4-Hours

International fellowships for scientific mobility. 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.

UNIT-IV**4-Hours**

Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Cooperatives, Voluntary Agencies/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

1. Bhalla GS & Singh G. 2001. Indian agriculture-four decades of development. Sage Publ.
2. Punia MS. Manual on international research and research ethics. CCS, Haryana Agricultural University, Hisar.
3. Rao BSV. 2007. Rural development strategies and role of institutions-issues, innovations and initiatives. Mittal Publ.
4. Singh K.1998. Rural development -principles, policies and management. Sage Publ.

Course Title: Master Research	L	T	P	Credits
Course Code: VSC600	0	0	0	2

Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Conduct an investigation and solve scientific problems using a range of methods, and apply appropriate and/or theoretical techniques
- 2 Negotiate, plan, design and execute a research-based project.
- 3 Analyse data and provide a written report or thesis on the methodology and outcomes in an appropriate format.
- 4 Learn the methodology of planning, layout, data recording, analysis, interpretation and report writing of plant pathology experiments
- 5 Familiarize with indexing databases, citation databases: Web of Science, Scopus, etc.

Semester - II

Course Title: Production Technology of Warm Season Vegetable Crops	L	T	P	Credits
Course Code: VSC505	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Impart knowledge Production, quality and yield of summer vegetable crops
2. Acquaint with production technology of summer vegetable crops.
3. Gain practical knowledge for the preparation of land for cultivation of vegetable crops
4. Acquire knowledge about the production technology and post-harvest handling of warm season vegetable crops and calculate the economics of vegetable production in India

Theory Content**Unit I****7 hours**

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/ planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marking), pest and disease management and economics of crops.

Fruit vegetables — Tomato, brinjal, hot pepper, sweet pepper and Okra.

Unit II**8Hours**

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/ planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marking), pest and disease management and economics of crops.

Beans—French bean, Indian bean (Sem), cluster bean and cowpea.

Unit III**8Hours**

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/ planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marking), pest and disease management and economics of crops.

Cucurbits—Cucumber, melons, gourds, pumpkin and squashes.

Unit IV**7Hours**

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/ planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, weed control, mulching, role of plant growth regulators,

physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marking), pest and disease management and economics of crops.

Tuber crops—Sweet potato, elephant foot yam, tapioca, taro and yam and Leafy vegetables—Amaranth and drumstick.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Cooperative Learning, Classroom lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures.

Suggested Readings

- *Swarup, V. 2006. Vegetable Science and Technology In India: Kalyani Publishers, India. Pp 656.*
- *Kabir, J., Maity, T. K., Bose, T. K. 2002. Vegetable Crops Vol. 1: Naya Prokash, India. Pp 668.*
- *Kabir, J., Maity, T. K., Bose, T. K. 2002. Vegetable Crops Vol. 2: Naya Prokash, India. Pp 489*
- *Kabir, J., Maity, T. K., Bose, T. K. 2003. Vegetable Crops Vol. 3: Naya Prokash, India. Pp 550*
- *Hazra, P., Karmakar, K., Chattopadhyay, A. 2011. Modern Technology in Vegetable Production.: New India Publishing Agency, India. Pp 442.*

Selected Journals list for reading

- IIVR Bulletins
- Indian Journal of Horticulture Indian Journal of Plant Physiology

Course Title: Lab- Production Technology of Warm Season Vegetable Crops	L	T	P	Credits
Course Code: VSC506	0	0	2	1

Practical Content**Total Hours: 15**

1. Scientific raising of nursery and seed treatment
2. Sowing and transplanting.
3. Description of commercial varieties and hybrids.
4. Demonstration on methods of irrigation, fertilizers and micronutrients application.
5. Mulching practices, weed management
6. Use of plant growth substances in summer season vegetable crops.
7. Study of nutritional and physiological disorders
8. Identification of important pest and diseases and their control
9. Preparation of cropping scheme for commercial farms

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Cooperative Learning, Classroom lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures.

Suggested Readings

Swarup, V. 2006. Vegetable Science and Technology In India: Kalyani Publishers, India. Pp 656.

Kabir, J., Maity, T. K., Bose, T. K. 2002. Vegetable Crops Vol. 1: Naya Prokash, India. Pp 668.

Kabir, J., Maity, T. K., Bose, T. K. 2002. Vegetable Crops Vol. 2: Naya Prokash, India. Pp 489

Kabir, J., Maity, T. K., Bose, T. K. 2003. Vegetable Crops Vol. 3: Naya Prokash, India. Pp 550

Hazra, P., Karmakar, K., Chattopadhyay, A. 2011. Modern Technology in Vegetable Production.: New India Publishing Agency, India. Pp 442

Course Title: Breeding of Cross Pollinated Vegetable Crops	L	T	P	Credits
Course Code: VSC507	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Have knowledge about principles and practices adopted for breeding of Cross pollinated vegetable crops
2. Get acquaint about floral biology of cross pollinated vegetable crops
3. Impart knowledge about different methods of breeding followed for breeding.
4. Use basic biometric genetics in computation of various parameters of Cross-pollinated vegetables

Theory Content

Unit-1

6Hour

History of vegetable breeding, Origin, botany, taxonomy, cytogenetic, genetics , breeding objectives, breeding methods (introduction ,selection, hybridization, mutation), quality improvement of capsicum, chilli, muskmelon, watermelon.

Unit-2

7Hour

History of vegetable breeding, Origin, botany, taxonomy, cytogenetic, genetics , Breeding objectives, breeding methods (introduction ,selection, hybridization, mutation), quality improvement cucumber, bottle gourd, long melon, bitter gourd, sponge gourd, summer squash.

Unit-3**7Hour**

History of vegetable breeding, Origin, botany, taxonomy, cytogenetic, genetics , Breeding objectives, breeding methods (introduction ,selection, hybridization, mutation),quality improvement of ole crops (cabbage, cauliflower, broccoli, brussels'), asparagus, leafy vegetables and spices (black pepper, turmeric, cardamom, coriander).

Unit-4**10Hour**

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.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Ram, H. H. 2012. Vegetable Breeding: Principle and Practices. Kalyani Publishers, India. Pp 791.*
- *Bergh, B. 2012. Genetic Improvement of Vegetable Crops. Elsevier Science, Netherlands. Pp 846*
- *Peter, KV and Pradeep Kumar, T. 1998 Genetics and Breeding of Vegetables, ICAR, Krishi Anusandhan Bhawan, New Delhi, India. Pp 333(Revised 2009).*

Course Title: Lab-Breeding of Cross Pollinated Vegetable Crops	L	T	P	Credits
Course Code: VSC508	0	0	2	1

Practical Contents**Total Hours: 15**

1. Selection indices in Cole crops
2. Selection indices of cucurbitaceous crops, bulb crops,
3. Selection indices of root crops, leafy vegetables and spices.
4. Selfing and crossing techniques in cross pollinated vegetable crops.
5. Biometrical analysis -Line x tester analysis, North Carolina Designs,
6. Stability analysis, Triple test cross analysis, generation mean analysis, diallel analysis.
7. Estimation of heritability, heterosis and combining ability.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Ram, H. H. 2012. Vegetable Breeding: Principle and Practices. Kalyani Publishers, India. Pp 791.*
- *Bergh, B. 2012. Genetic Improvement of Vegetable Crops. Elsevier Science, Netherlands. Pp 846*
- *Peter, K. V. and Pradeep Kumar, T. 1998 Genetics and Breeding of Vegetables, ICAR, Krishi Anusandhan Bhawan, New Delhi, India. Pp 333(Revised 2009).*

Course Title: Postharvest Management of Vegetable Crops	L	T	P	Credits
Course Code: VSC509	1	0	0	1

Total Hours 15

Learning outcome: After completion of this course, the learner will be able to:

1. Learn about regulation of postharvest losses by using chemicals and growth regulators.
2. Inculcate Pre and postharvest treatments for extending shelf life of vegetable crops.
3. Establish knowledge about Packinghouse operations for extending the shelf life of vegetable crops.
4. Plan the methods of storage of vegetable crops.

Theory Content

Unit I

5Hrs

Importance and scope of post-harvest management of Vegetables. Maturity indices and standards for different vegetables; Methods of maturity determination; Biochemistry of maturity and ripening; Enzymatic and textural changes; Ethylene evolution and ethylene management; Respiration and transpiration along with their regulation methods

Unit II

5Hrs

Harvesting tools and practices for specific market requirement; Postharvest physical and biochemical changes; Pre-harvest practices and other factors affecting postharvest losses

Unit III**3Hrs**

Packing house operations; Commodity pretreatments chemicals, wax coating, precooling and irradiation; Packaging of vegetables, prevention from infestation, management of postharvest diseases and principles of transportation

Unit IV**2Hrs**

Ventilated, refrigerated, modified atmosphere and controlled atmosphere storage, hypobaric storage and cold storage; Zero-energy cool chamber, storage disorders like chilling injury in vegetables

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Thompson AK. (Ed.). 2014. Fruit and vegetables: harvesting, handling and storage (Vol. 1 and Blackwell Publishing Ltd, Oxford, UK. ISBN: 9781118654040.*
- *Verma LR and Joshi VK. 2000. Postharvest technology of fruits and vegetables: handling, processing, fermentation and waste management. Indus Publishing Company, New Delhi, India. ISBN 8173871086.*
- *Willis R, McGlassen WB, Graham D and Joyce D. 1998. Postharvest: An introduction to the physiology and handling of fruits, vegetables and ornamentals. CABI.*
- *Wills RBH and Golding J. 2016. Postharvest: an introduction to the physiology and handling of fruit and vegetables, CABI Publishing, ISBN 9781786391483.*

Course Title: Lab-Postharvest Management of Vegetable Crops	L	T	P	Credits
Course Code: VSC510	0	0	2	1

Practical Content**Total Hrs. 15**

1. Studies on stages and maturing indices.
2. Ripening of commercially important vegetable crops.
3. Studies of harvesting, pre-cooling, pre-treatments, physiological disorders- chilling injury.
4. Improved packaging.
5. Use of chemicals for ripening and enhancing shelf life of vegetables.
6. Physiological loss in weight, estimation of transpiration, respiration rate and ethylene release
7. Storage of important vegetables
8. Cold chain management.
9. Visit to commercial packinghouse, cold storage and control atmosphere storage

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Thompson AK. (Ed.). 2014. Fruit and vegetables: harvesting, handling and storage (Vol. 1 and Blackwell Publishing Ltd, Oxford, UK. ISBN: 9781118654040.*
- *Verma LR and Joshi VK. 2000. Postharvest technology of fruits and vegetables: handling, processing, fermentation and waste management. Indus Publishing Company, New Delhi, India. ISBN 8173871086.*
- *Willis R, McGlassen WB, Graham D and Joyce D. 1998. Postharvest: An introduction to the physiology and handling of fruits, vegetables and ornamentals. CABI.*
- *Wills RBH and Golding J. 2016. Postharvest: an introduction to the physiology and handling offruit and vegetables, CABI Publishing, ISBN 9781786391483.*

Course Title: Sub-tropical and Temperate Fruit Production	L	T	P	Credits
Course Code: FSC501	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Get familiarize with the basic knowledge of importance, uses, origin, distribution, area and production of subtropical and temperate fruits.
- 2 Acquire technical knowhow regarding soil, climatic, water quality, biotic/abiotic factors limiting fruit production.
- 3 Learn the importance and methods of planting, root stock, propagation, fruit growth and development, fertigation, fertilization, nutrient and water management.
- 4 Develop the methodology of training, pruning, quality improvement, pollination, fruit set, physiology and plant protection of sub-tropical and temperate fruits.

Theory content

Origin, distribution, commercial importance and export potential. Eco-physiological requirements. Species and varieties. Rootstocks and propagation. Planting, root zone, training and pruning, Nutrition and water requirements, fertigation, role of bio- regulators, major pests, diseases, physiological disorders and their control measures, Nutrition and water requirements, fertigation, role of bio-regulators, major pests, diseases, physiological disorders and their control measures, Abiotic factors limiting fruit production. Flowering, pollination and fruit set. Quality improvement. Storage and ripening techniques. Industrial and export potential, Agri. Export Zones (AEZ) and industrial support.

Unit I**8 hours**

Fruit Crops -Apple, pear, quince, grapes, plum, peach,

Unit II**7 hours**

Fruit Crops - Apricot, cherries, hazelnut, litchi, loquat, persimmon.

Unit III**7 hours**

Fruit Crops - Kiwifruit, strawberry, walnut, almond, pistachio, pecan, mangosteen, carambola,

Unit IV**8 hours**

Fruit Crops – Bael, wood apple, fig, jamun, rambutan and pomegranate.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings

- *Yadav, P.K.2014. Production Technology of Tropical and Subtropical Fruits. New India publishing Agency. pp. 384.*
- *Chadha, K. L. 2012. Hand Book of Horticulture. ICAR, New Delhi. pp.1057.*
- *Singh, S., Shivankar, V.J., Srivastava, A.K. and Singh, I.P. 2004. Advances in Citriculture. Jagminder Book Agency. pp.256.*

Course Title: Lab-Sub-tropical and Temperate Fruit Production	L	T	P	Credits
Course Code: FSC502	0	0	2	1

Practical Content**Total Hours: 15**

1. Description and identification of species and varieties.
2. Growth and development.
3. Growth regulation.
4. Nutritional and physiological disorders and their control.
5. Rejuvenation of old and unproductive trees.
6. Visit to commercial orchards.
7. Project preparation for establishing commercial orchards.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings

- *Yadav, P.K. 2014. Production Technology of Tropical and Subtropical Fruits. New india publishing Agency. pp. 384.*
- *Chadha, K. L. 2012. Hand Book of Horticulture. ICAR, New Delhi. pp.1057.*
- *Singh, S., Shivankar, V.J., Srivastava, A.K. and Singh, I.P. 2004. Advances in Citriculture. Jagminder Book Agency. pp.256.*

Course Title: Commercial Production of Loose Flowers	L	T	P	Credits
Course Code: FLS509	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Learn about production and post-harvest management of loose flowers.
2. Develop the required skills on commercial production management.
3. Identify deficiency symptoms of nutrients in loose flower crops.
4. Acquaint with production technology of loose flower crops.

Theory Content

Scope, scenario and importance of loose flowers, constraints and opportunities in loose flower production. Growing environment: Nursery management, pro-tray nursery under shade nets, soil and climate requirement, Field preparation, systems of planting. Crop management: Soil analysis, soil health card, water and nutrient management, weed management, training and pruning, special horticultural practices such as pinching and disbudding, use of growth regulators, physiological disorders and remedies, INM, IPM and IDM. Crop regulation: Flower forcing and year round flowering, production for special occasions through physiological interventions and chemical regulation.

Unit-I

5 hours

Flower Crops- Rose, jasmine, chrysanthemum, marigold, tuberose, china aster,

Unit-II**8 hours**

Flower Crops- Crossandra, gaillardia, spider lily, hibiscus, nerium,

Unit-III**7 hours**

Flower Crops- Barleria, celosia, gomphrena, Madar (Calotropis gigantea), nyctanthes (Harsingar),

Unit-IV**10 hours**

Flower Crops- Tabernaemontana (Chandni), lotus, water lily, michelia (Champa), gardenia, ixora and balsam.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

- Arora JS. 2010. Introductory Ornamental Horticulture. Kalyani Publishers. 6th edition, pp. 230.
- Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.
- Bose TK, Maiti, RG, Dhua RS and Das P. 1999. Floriculture and Landscaping. Prokash, Kolkata, India.
- Bose TK and Yadav LP. 1989. Commercial Flowers. Naya Prokash, Kolkata, India.
- Chadha KL and Bhattacharjee SK. 1995. Advances in Horticulture: Ornamental Plants. Vol. XII, Parts 1 & 2. pp. 533,
- Chadha KL and Chaudhury B. 1992. Ornamental Horticulture in India. ICAR, New Delhi, India.
- Dole JM and Wilkins HF. 2004. Floriculture-Principles and Species. Prentice Hall. 2nd edition, pp. 1048.

Course Title: Lab-Commercial Production of Loose Flowers	L	T	P	Credits
Course Code: FLS510	0	0	2	1

Practical Content**Total Hours: 15**

1. Identification of species and varieties.
2. Propagation and nursery management.
3. Training and pruning techniques.
4. Fertigation, foliar nutrition, growth regulator application.
5. Crop protection of loose flowers.
6. Pinching, disbudding, staking, harvesting techniques.
7. Post-harvest handling, storage and cold chain.
8. Project preparation for regionally important commercial loose flowers.
9. Crop specific guidelines for project financing (NHB guidelines).
10. Cost Economics and exposure Visits to fields.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

- Arora JS. 2010. Introductory Ornamental Horticulture. Kalyani Publishers. 6th edition, pp. 230.
- Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.
- Bose TK, Maiti, RG, Dhua RS and Das P. 1999. Floriculture and Landscaping. Prokash, Kolkata, India.
- Bose TK and Yadav LP. 1989. Commercial Flowers. Naya Prokash, Kolkata, India.
- Chadha KL and Bhattacharjee SK. 1995. Advances in Horticulture: Ornamental Plants. Vol. XII, Parts 1 & 2. pp. 533.
- Chadha KL and Chaudhury B. 1992. Ornamental Horticulture in India. ICAR, New Delhi, India.
- Dole JM and Wilkins HF. 2004. Floriculture-Principles and Species. Prentice Hall. 2nd edition, pp. 1048.

Course Title: Seminar	L	T	P	Credits
Course Code: VSC557	0	0	0	1

Total Hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Show competence in identifying relevant information, defining and explaining topics under discussion
- 2 Present the classical and innovative work related to plant pathology subject.
- 3 Reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem
- 4 Judge when to speak and how much to say, speak clearly and audibly in a manner appropriate to the subject

Course Title: Lab-Fundamentals of Computer Applications	L	T	P	Credits
Course Code: CA551	0	0	4	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Learn and understand about basics of MS-Word, Excel, preparation of Graphs
- 2 Read, understand, and interpret material on technology. They will have an appreciation for some of the ideas, issues, and problems involved in writing about technology and in workplace writing.
- 3 Understand the operating systems, peripheral devices, networking, multimedia and internet
- 4 Familiarize with basic sources and methods of research and documentation on topics in technology, including on-line research, integrate material from primary and secondary sources with their own ideas in research papers.

Practical Content

1. Ms-word: creating a document and saving and editing,
2. Use of options from tool bars, format, insert and tools(spelling and grammar), alignment of text.
3. Creating a table, merging cells, column and row width.
4. Ms-excel: entering expressions through the formula tool.
5. Use of inbuilt functions, sum, average, max, min.
6. Creating graphs and saving with and without data in Ms-excel.
7. Ms-access: creating database, structuring with different types of fields.
8. Ms-power point: preparation of slides on power point.
9. Internet Browsing: browsing a web page and creating of E-Mail ID. Agri. Net (ARIS).

Suggested Readings:

- Salaria, R.S. 2017. *Computer Fundamentals*. Darya Ganj, New Delhi. pp. 486.
- Manish, S. and Bhatt, A. 2016. *Computers in Agriculture: Fundamentals and Applications*. New India Publishing Agency. New Delhi. pp. 190.
- Manjunath, B.E. 2010. *Computer Basics*. Vasan Publications, Bengaluru, Karnataka. Pp. 356.

Course Title: Master Research	L	T	P	Credits
Course Code: VSC600	0	0	0	5

Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Conduct an investigation and solve scientific problems using a range of methods, and apply appropriate and/or theoretical techniques
- 2 Negotiate, plan, design and execute a research-based project.
- 3 Analyse data and provide a written report or thesis on the methodology and outcomes in an appropriate format.
- 4 Learn the methodology of planning, layout, data recording, analysis, interpretation and report writing of plant pathology experiments and familiarize with indexing databases, citation databases: Web of Science, Scopus, etc.

Course Title: Lab – Basic Concepts in Laboratory Techniques	L	T	P	Credits
Course Code: PGC551	0	0	2	1

Total Hours-30

Course Outcomes:

On successful completion of this course, the students will able to:

1. To acquaint the students about the basics of commonly used techniques in laboratory.
2. Preparation of solutions of acids
3. Get knowledge on Drying of solvents/chemicals
4. Electric wiring and earthing

Course Content:

- Safety measures while in Lab
- Handling of chemical substances
- Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware
- Drying of solvents/chemicals
- Weighing and preparation of solutions of different strengths and their dilution
- Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications

- Preparation of solutions of acids
- Neutralization of acid and bases
- Preparation of buffers of different strengths and pH values
- Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath.
- Electric wiring and earthing. Preparation of media and methods of sterilization
- Seed viability testing, testing of pollen viability Tissue culture of crop plants; Description of flowering plants in botanical

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

- Furr AK. 2000. CRCH and Book of Laboratory Safety. CRC Press.
- Gabb MH & Lat chem. WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

Semester III

Course Title: Breeding of Self Pollinated and Vegetative Propagated Vegetable Crops	L	T	P	Credits
Course Code: VSC511	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Gain practical knowledge about the selection of parents, Analysis of different qualitative and quantitative characters in germplasm, hybrids and segregating generations.
2. Know about the use of molecular markers and biotechnology in Self-pollinated vegetables.
3. Have knowledge about the different methods of breeding and screening for self-pollinated vegetables for abiotic and biotic stress.
4. Gain practical knowledge about the different methods of hybrid seed production of self-pollinated and use basic biometric techniques in computation of various parameters of Self-pollinated vegetables.

Theory Content

Unit-I

5 Hours

Selection of desirable plants from breeding population. Observations and analysis of various qualitative and quantitative traits using germplasm, hybrids and segregating generations.

Unit-II

6Hours

Induction of flowering. Selfing and crossing techniques in vegetable crops. Hybrid seed production of vegetable crops in bulk. Screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops.

Unit-III

7Hours

Demonstration of sib-mating and mixed population.

Unit-IV

12Hours

Molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Ram, H. H. 2012. Vegetable Breeding: Principle and Practices: Kalyani Publishers, India. Pp 791.
- Bergh, B. 2012. Genetic Improvement of Vegetable Crops: Elsevier Science, Netherlands. Pp 846
 - Peter, K V and Pradeep Kumar, T. 1998 Genetics and Breeding of Vegetables, ICAR, Krishi Anusandhan Bhawan, New Delhi, India. Pp 333(Revised 2009).

Course Title: Lab-Breeding of Self Pollinated and Vegetative Propagated Vegetable Crops	L	T	P	Credits
Course Code: VSC512	0	0	2	1

Practical Content**Total Hours: 15**

1. Selection of desirable plants from breeding population.
2. Observations and analysis of various qualitative and quantitative traits using germplasm, hybrids and segregating generations.
3. Observations and analysis of various quantitative traits using germplasm, hybrids and segregating generations
4. Induction of flowering.
5. Selfing and crossing techniques in vegetable crops.
6. Crossing techniques in vegetable crops
7. Hybrid seed production of vegetable crops in bulk.
8. Screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops.
9. Demonstration of sib-mating and mixed population.
10. Molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Ram, H. H. 2012. Vegetable Breeding: Principle and Practices: Kalyani Publishers, India. Pp 791.
- Bergh, B. 2012. Genetic Improvement of Vegetable Crops: Elsevier Science, Netherlands. Pp 846
- Peter, K V and Pradeep Kumar, T. 1998 Genetics and Breeding of Vegetables, ICAR, Krishi Anusandhan Bhawan, New Delhi, India. Pp 333(Revised 2009).

Course Title: Organic Vegetable Production	L	T	P	Credits
Course Code: VSC513	1	0	0	1

Total Hours: 15

Learning outcome: After completion of this course, the learner will be able to:

1. Appreciate the scope and scenario of organic vegetable production in India.
2. Acquire knowledge about the organic vegetable production technology.
3. Manage soil fertility, crop rotation and post-harvest of organic vegetables.
4. Adopt production of organic vegetable crops as an entrepreneur.

Theory Content

Unit I

3Hours

Importance, principles, perspective, concepts and components of organic farming in vegetable crops

Unit II

4Hours

Organic production of vegetable crops, viz. Solanaceous, Cucurbitaceous, Cole, root and tuber crops

Unit III

4Hours

Managing soil fertility, mulching, raising green manure crops, weed management in organic farming system; Crop rotation in organic production; Processing and quality control of organic vegetable produce

Unit IV

4Hours

Indigenous methods of composting, Panchyagavya, Biodynamics preparations and their application; ITKs in organic vegetable farming; Role of botanicals and bio-control agents in the management of pests and diseases in vegetable crops Certification and export—Techniques of natural vegetable farming, GAP and GMP certification of organic products; Export- opportunity and challenges.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

- Dahama AK. 2005. *Organic farming for sustainable agriculture*. 2nd Ed. Agrobios.
- Gehlot G. 2005. *Organic farming; standards, accreditation certification and inspection*. Agrobios.
- Palaniappan SP and Annadorai K. 2003. *Organic farming, theory and practice*. Scientific publ.
- Pradeepkumar T, Suma B, Jyothibhaskar and Satheesan KN. 2008. *Management of horticultural crops*. New India Publ. Agency.
- Shivashankar K. 1997. *Food security in harmony with nature*. 3rd IFOAMASIA, Scientific Conf. 1- 4 December, UAS, Bangalore.

Course Title: Lab-Organic Vegetable Production	L	T	P	Credits
Course Code: VSC514	0	0	2	1

Practical Content**Total Hours: 15**

1. Methods of preparation and use of compost, vermicompost, biofertilizers and biopesticides.
2. Soil solarization.
3. Use of green manures.
4. Waste management; Organic soil amendments in organic production of vegetable crops.
5. Weed, pest and disease management in organic vegetable production.
6. Visit to organic fields and marketing centres.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

- Dahama AK. 2005. *Organic farming for sustainable agriculture*. 2nd Ed. Agrobios.
- Gehlot G. 2005. *Organic farming; standards, accreditation certification and inspection*. Agrobios.
- Palaniappan SP and Annadorai K. 2003. *Organic farming, theory and practice*. Scientific publ.
- Pradeepkumar T, Suma B, Jyothibhaskar and Satheesan KN. 2008. *Management of horticultural crops*. New India Publ. Agency.
- Shivashankar K. 1997. *Food security in harmony with nature*. 3rd IFOAMASIA, Scientific Conf. 1- 4 December, UAS, Bangalore.

Course Title: Lab- Technical Writing and Communication Skills	L	T	P	Credits
Course Code: PGC504	0	0	2	1

Total 4 Hours:

Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Understand and know how to follow the stages of the writing process (prewriting/writing/rewriting) and
- 2 Apply them to technical and workplace writing tasks
- 3 Produce a set of documents related to technology and writing in the workplace and will have improved their ability to write clearly and accurately
- 4 Establish the basic components of definitions, descriptions, process explanations, and other common forms of technical writing.

Practical Content

1. Various forms of scientific writings: theses, technical papers, review, manuals etc.
2. Various parts of thesis and research communications: title page, authorship contents page, preface, introduction, review of literature,

Course Title: Master Research	L	T	P	Credits
Course Code: VSC600	0	0	0	10

Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Conduct an investigation and solve scientific problems using a range of methods, and apply appropriate and/or theoretical techniques
- 2 Negotiate, plan, design and execute a research-based project.
- 3 Analyse data and provide a written report or thesis on the methodology and outcomes in an appropriate format.
- 4 Learn the methodology of planning, layout, data recording, analysis, interpretation, report writing of plant pathology experiments and familiarize with indexing databases, citation databases: Web of Science, Scopus, etc.

Semester IV

Course Title: Growth and Development of Vegetable Crops	L	T	P	Credits
Course Code: VSC515	2	0	0	1

Total Hours: 15**Learning outcome:**

After completion of this course, the learner will be able to:

1. Acquire knowledge about the growth and development of plants in vegetable crops
2. Distinguish between primary and secondary growth in plant stems.
3. Obtain knowledge how to apply synthetic PGRs, role and mode of action in vegetable crop production
4. Understand how hormones affect the growth and development of vegetable crops

Theory Content**Unit I****3Hours**

Definition of growth and development; Cellular structures and their functions; Physiology of phyto-hormones functioning/ biosynthesis and mode of action; Growth analysis and its importance in vegetable production.

Unit II**4Hours**

Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellins, cytokinins and abscissic acid; Application of

synthetic PGRs including 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

4Hours

Abiotic factors—Impact of light, temperature, photoperiod, carbon dioxide, oxygen and other gases on growth, development of underground parts, flowering and sex expression in vegetable crops; Apical dominance.

Unit IV

4Hours

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. Morphogenesis and tissue culture techniques in vegetable crops; Grafting techniques in different vegetable crops.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

- Bleasdale JKA. 1984. *Plant physiology in relation to horticulture* (2nd Edition) MacMillan.
- Gupta US. Eds. 1978. *Crop physiology*. Oxford and IBH, New Delhi.
- Kalloo G. 2017. *Vegetable grafting: Principles and practices*. CAB International
- Krishnamoorti HN. 1981. *Application growth substances and their uses in agriculture*. Tata McGraw Hill, New Delhi.
- Leopold AC and Kriedemann PE. 1981. *Plant growth and development*, Tata McGraw-Hill, New Delhi.
- Peter KV and Hazra P. (Eds). 2012. *Hand book of vegetables*. Studium Press LLC, P.O. Box 722200, Houston, Texas 77072, USA, 678p.
- Peter KV. (Eds). 2008. *Basics of horticulture*. New India publication agency, New Delhi.
- Rana MK. 2011. *Physio-biochemistry and Biotechnology of Vegetables*. New India Publishing Agency, Pritam Pura, New Delhi.
- Saini *et al.* (Eds.). 2001. *Laboratory manual of analytical techniques in horticulture*. Agrobios, Jodhpur.
- Wien HC. (Eds.). 1997. *The physiology of vegetable crops*. CAB International

Course Title: Lab-Growth and Development of Vegetable Crops	L	T	P	Credits
Course Code: VSC516	0	0	2	1

Practical Content**Total Hours: 15**

1. Preparation of plant growth regulator's solutions 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.
5. Checking flower and fruit drops and improving fruit set in solanaceous vegetables with plant growth substances.
6. Growth analysis techniques in vegetable crops.
7. Grafting techniques in tomato, brinjal, cucumber and sweet pepper.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

- Bleasdale JKA. 1984. *Plant physiology in relation to horticulture* (2nd Edition) MacMillan.
- Gupta US. Eds. 1978. *Crop physiology*. Oxford and IBH, New Delhi.
- Kalloo G. 2017. *Vegetable grafting: Principles and practices*. CAB International
- Krishnamoorti HN. 1981. *Application growth substances and their uses in agriculture*. Tata McGraw Hill, New Delhi.
- Leopold AC and Kriedemann PE. 1981. *Plant growth and development*, Tata McGraw-Hill, New Delhi.
- Peter KV and Hazra P. (Eds.). 2012. *Hand book of vegetables*. Studium Press LLC, P.O. Box 722200, Houston, Texas 77072, USA, 678p.
- Peter KV. (Eds.). 2008. *Basics of horticulture*. New India publication agency, New Delhi.
- Rana MK. 2011. *Physio-biochemistry and Biotechnology of Vegetables*. New India Publishing Agency, Pritam Pura, New Delhi.
- Saini *et al.* (Eds.). 2001. *Laboratory manual of analytical techniques in horticulture*. Agrobios, Jodhpur.
- Wien HC. (Eds.). 1997. *The physiology of vegetable crops*. CAB International

Course Title: Seed Production of Vegetable Crops	L	T	P	Credits
Course Code: VSC517	1	0	0	1

Total Hours 15

Learning outcome: After completion of this course, the learner will be able to:

1. Learn the scope and scenario of seed production of vegetable crops in India
2. Acquire knowledge about the complete seed production technology, extraction and post-extraction processing of vegetable seeds.
3. Inculcate Field and seed standards in important vegetable crops.
4. Adopt of seed production of vegetable crops as entrepreneur

Theory

Unit I

3Hrs

Introduction, definition of seed and its quality, seed morphology, development and maturation; Apomixis and fertilization; Modes of propagation and reproductive behaviour; Pollination mechanisms and sex forms in vegetables; History of vegetable seed production; Status and share of vegetable seeds in seed industry

Unit II

5Hrs

Agro-climate and its influence on quality seed production; Deterioration of crop varieties, genetical and agronomic principles of vegetable seed production; Methods of seed production, hybrid seeds and techniques of large scale hybrid seed production; Seed village concept

Unit III**4Hrs**

Seed multiplication ratios and replacement rates in vegetables; Generation system of seed multiplication; Maintenance and production of nucleus, breeder, foundation, certified/ truthful label seeds; Seed quality and mechanisms of genetic purity testing

Unit IV**3Hrs**

Maturity standards; Seed harvesting, curing and extraction; Seed processing, viz., cleaning, drying and treatment of seeds, seed health and quality enhancement, packaging and marketing; Principles of seed storage; Orthodox and recalcitrant seeds; Seed dormancy. Improved agro-techniques; Field and seed standards in important solanaceous, leguminous and cucurbitaceous vegetables, cole crops, leafy vegetables, bulbous and root crops and okra; clonal propagation and multiplication in vegetative propagated crops; Seed plot technique and true potato seed production in potato

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

- *Agarwal PK and Anuradha V. 2018. Fundamentals of seed science and technology. Brilliant publications, New Delhi.*
- *Agrawal PK and Dadlani M. (Eds.). 1992. Techniques in seed science and technology. South asian Publ.*
- *Agrawal RL. (Ed.). 1997. Seed technology. Oxford and IBH.*
- *Basra AS. 2000. Hybrid seed production in vegetables. CRC press, Florida, USA.*
- *Bench ALR and Sanchez RA. 2004. Handbook of seed physiology. Food products press, NY/London.*
- *Bendell PE. (Eds.). 1998. Seed science and technology: Indian forestry species. Allied Publ.*

- *Chakraborty SK, Prakash S, Sharma SP and Dadlani M. 2002. Testing of distinctiveness, uniformity and stability for plant variety protection. IARI, New Delhi*
- *Copland LO and McDonald MB. 2004. Seed science and technology, Kluwer Academic Press.*
- *Fageria MS, Arya PS and Choudhary AK. 2000. Vegetable crops: breeding and seed production. Vol. I. Kalyani Publishers, New Delhi.*
- *George RAT. 1999. Vegetable seed production (2nd Edition). CAB International*

Suggested Journals:

Scientia Horticulturae

Vegetable Science

Course Title: Lab-Seed Production of Vegetable Crops	L	T	P	Credits
Course Code: VSC518	0	0	2	1

Practical**15Hrs**

1. Study of floral biology and pollination mechanisms in vegetables;
2. Determination of modes of pollination;
3. Field and seed standards;
4. Use of pollination control mechanisms in hybrid seed production of important
5. vegetables;
6. Maturity standards and seed extraction methods;
7. Seed sampling and testing;
8. Visit to commercial seed production areas;
9. Visit to seed processing plant and seed testing laboratories.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

- *Agarwal PK and Anuradha V. 2018. Fundamentals of seed science and technology. Brilliant publications, New Delhi.*
- *Agrawal PK and Dadlani M. (Eds.). 1992. Techniques in seed science and technology. South Asian Publ.*
- *Agrawal RL. (Ed.). 1997. Seed technology. Oxford and IBH.*
- *Basra AS. 2000. Hybrid seed production in vegetables. CRC press, Florida, USA.*
- *Bench ALR and Sanchez RA. 2004. Handbook of seed physiology. Food products press, NY/London.*
- *Bendell PE. (Eds.). 1998. Seed science and technology: Indian forestry species. Allied Publ.*
- *Chakraborty SK, Prakash S, Sharma SP and Dadlani M. 2002. Testing of distinctiveness, uniformity and stability for plant variety protection. IARI, New Delhi*
- *Copland LO and McDonald MB. 2004. Seed science and technology, Kluwer Academic Press.*
- *Fageria MS, Arya PS and Choudhary AK. 2000. Vegetable crops: breeding and seed production. Vol. I. Kalyani Publishers, New Delhi.*
- *George RAT. 1999. Vegetable seed production (2nd Edition). CAB International.*
- *Kalloo G, Jain SK, Vari AK and Srivastava U. 2006. Seed: A global perspective. Associated publishing company, New Delhi.*

Course Title: Intellectual Property and its management in Agriculture	L	T	P	Credits
Course Code: PGC505	1	0	0	1

Total Hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Recognize the importance of IP and to educate the pupils on basic concepts of Intellectual Property Management in Agriculture.
2. Identify the significance of practice and procedure of Patents.
3. Make the students to understand the statutory provisions of different forms of Intellectual Property Management in simple forms.
4. Develop the procedure of obtaining Patents, Copyrights, Trade Marks, Industrial Design and to keep their IP rights alive.

Theory Content

Unit-I

2Hrs

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).

Unit-II

4Hrs

Benefits of securing IPRs; 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**5Hrs**

Protection of plant varieties and farmers' rights and biodiversity protection; 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**4Hrs**

International treaty on plant genetic resources for food and agriculture; licensing of technologies, material transfer agreements, research collaboration agreement, license agreement.

Suggested readings:

- Erbis FH and Maredia K.1998. *Intellectual Property Rights in Agricultural Biotechnology*. CABI.
- Ganguli P. 2001. *Intellectual Property Rights: Unleashing Knowledge Economy*. McGraw-Hill.
- *Intellectual Property Rights: Key to New Wealth Generation*. 2001. NRDC and Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. *State of Indian Farmer*. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
- Rothschild M and Scott N. (Ed.). 2003. *Intellectual Property Rights in Animal Breeding and Genetics*. CABI.
- Saha R. (Ed.). 2006. *Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies*. Daya Publ. House.

Course Title: Master Research	L	T	P	Credits
Course Code: VSC600	0	0	0	13

Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Conduct an investigation and solve scientific problems using a range of methods, and apply appropriate and/or theoretical techniques
- 2 Negotiate, plan, design and execute a research-based project.
- 3 Analyse data and provide a written report or thesis on the methodology and outcomes in an appropriate format.
- 4 Learn the methodology of planning, layout, data recording, analysis, interpretation and report writing of plant pathology experiments
- 5 Familiarize with indexing databases, citation databases: Web of Science, Scopus, etc.