

**GURU KASHI UNIVERSITY**



**Master of Science (Vegetable Science)**

**Session: 2022-23**

**Department of Vegetable Science**

### **Graduate Attributes**

1. The students will know the packages of practices of warm season vegetables.
2. The students will know the packages of practices of winter season vegetables
3. To educate about principles and practices adopted for breeding of Self- pollinated and Vegetative propagated vegetable crops.
4. To learn about principles and practices adopted for breeding of Cross pollinated Vegetable crops
5. To make the students familiar with principles and practices of processing of vegetable crops.
6. The students will know about morphological, cytological and molecular taxonomy of Vegetable crops and their evolution.
7. The students will know about the specific plant breeding activities, such as election of parental germplasm, observation and recording of phenotypic variation and selection among progeny.
8. To impart knowledge in the field of biometry as applied to breeding, population and making experiment in Vegetable genetics and Vegetable breeding.
9. The students will be well versed with package of practices of underexploited vegetables so as to enhance their production.
10. The students will have the knowledge of basic principles of computer programming and its application in problem solving.

### **PROGRAMME OUTCOMES**

1. The students will know about the packages of practices of warm season, winter season and underexploited vegetable crops.
2. The students will know about the breeding programmes, morphological, evolution, classification of vegetable crops. The making of experiment of vegetable genetics and breeding. The scientific writings of thesis by using computer programming and application.
3. Students will know about different aspects of research related to

production technology and breeding of vegetables and ethics of synopsis and thesis writing.

**Programme Structure**

<b>Semester: Flexible study scheme (01 )</b>							
<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>No. of Credits</b>
1	MVS101	Production Technology of Summer Season Vegetable Crops*	T	2	0	0	2
2	MVS103	Production Technology of Winter Season Vegetable Crops*	T	2	0	0	2
3	MVS105	Breeding of Self Pollinated and Vegetative Propagated Vegetable Crops*	T	2	0	0	2
4	MVS107	Breeding of Cross Pollinated Vegetable Crops*	T	2	0	0	2
5	MVS109	Systematic of Vegetable Crops*	T	2	0	0	2
6	MVS111	Post-Harvest Handling of Vegetable Crops*	T	2	0	0	2
7	MVS113	Principles of Plant Breeding.	T	2	0	0	2
8	MVS115	Principles of quantitative Genetics	T	2	0	0	2
9	MVS117	Production Technology of	T	2	0	0	2

		Under Exploited Vegetable Crops					
10	MVS118	Soil Fertility and Fertilizer Use	T	2	0	0	2
11	MVS120	Agriculture Statistics	T	3	0	0	3
12	MVS125	Seminar-I	P	NA	NA	2	1
13	MVS126	Seminar-II	P	NA	NA	2	1
14	MVS102	Lab- Production Technology of Summer Season Vegetable Crops*	P	0	0	2	1
15	MVS104	Lab- Production Technology of Winter Season Vegetable Crops*	P	0	0	2	1
16	MVS106	Lab- Breeding of Self Pollinated and Vegetative Propagated Vegetable Crops*	P	0	0	2	1
17	MVS108	Lab- Breeding of Cross Pollinated Vegetable Crops *	P	0	0	2	1
18	MVS110	Lab-Systematic of Vegetable Crops *	P	0	0	2	1

19	MVS112	Lab- Post Harvest Handling of Vegetable Crops*	P	0	0	2	1
20	MVS114	Lab-Principles of Plant Breeding.	P	0	0	2	1
21	MVS116	Lab-Principles of Quantitative Genetics	P	0	0	2	1
22	MVS119	Lab- Soil Fertility and Fertilizer Use.	P	0	0	2	1
23	MVS121	Lab- Agricultural Statistics	P	0	0	2	1
24	MVS122	Lab-Fundamentals of Computer Applications	P	0	0	2	1(NC)
25	MVS123	Lab- Library and Information Services	P	0	0	2	1(NC)
26	MVS124	Lab-Technical Writing and Communication Skills	P	0	0	2	1(NC)
27	MVS127	Master Research	P	NA	NA	48	24(NC)
<b>Elective Subjects</b>							
29	MVS128	Tropical & Dryland Fruit Production *	T	2	0	0	2
30	MVS129	Sub- Tropical and Temperate Fruit *Production	T	2	0	0	2

31	MVS130	Lab- Tropical & Dryland Fruit Production *	P	0	0	2	1
32	MVS131	Lab-Sub- Tropical and Temperate Fruit Production*	P	0	0	2	1
<b>Total No. of Credits</b>							<b>38+27 (NC)</b>

**Note: Students are allowed to register for MOOC courses in every odd semester**

#### Evaluation Criteria for Theory Courses

A. Continuous Assessment: [25 Marks]

- i. CA1 (10 Marks)
- ii. CA2 (10 Marks)
- iii. CA3 ( 5 Marks)

B. Attendance (5 marks)

C. MST-1: (30 Marks)

D. MST-2: (20Marks)

E. End-Term Exam: (20 Marks)

**For the CAs the teacher shall take surprised test/term paper/quiz/ Surprise Test.**

**Evaluation Criteria for other courses has been given separately with the respective courses.**

#### Evaluation Criteria for practical Courses

The syllabus of subject is divided into five experiments, each experiment contain 20 marks (10 lab performance, 5 viva, 5 lab record)- Total marks 100

#### Evaluation Criteria for Seminar

It is of total Marks-100

Collection of review of literature - 20marks

Data Analysis -20 marks

Power Point Presentation - 20 marks

Presentation skills - 20 marks

Viva voce - 20 marks

<b>Course Title:</b> Production Technology of Summer Season Vegetable Crops	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS101	2	0	0	2

### Evaluation Criteria for Master Research

The evaluation is Satisfactory or Unsatisfactory on the basis of the performance of the candidate.

### Learning Outcomes

On the completion of the course the students will be able to

- 1 Identify deficiency symptoms of nutrients in 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 Know about innovative nursery raising technique for summer vegetable
- 5 Crops for raising quality, disease, pest and harvesting induces Schedule the cropping scheme for successful cultivation of summer season vegetables

### Course Content

#### Unit-1

8

1. Introduction, nutritional value, origin, botany and taxonomy of summer vegetables.
2. Important countries and states growing vegetables along with area, climate and soil requirements summer vegetables.

#### Unit-2

7

1. Commercial varieties/hybrids evolved by private and public sector.
2. Sowing/ transplanting time, seed rate, seed treatment summer vegetables.
3. Nutritional and irrigation requirements, chemical weed control, mulching, physiological disorders summer vegetables.

#### Unit-3

8

1. Harvesting techniques, post-harvest management of warm season vegetable crops i.e. solanaceous crops, okra, cucurbitaceous crops, cowpea, sweet potato, cluster beans, amaranth, basella, kang-kong, tapioca.
2. Plant protection measures and seed production of warm season vegetable crops solanaceous crops, okra, cucurbitaceous crops, cowpea, sweet potato, cluster beans, amaranth, basella, kang-kong, tapioca.



**Unit-4**

**7**

1. Poly-house, net-house and low tunnel technology for off-season production of summer 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**

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

<b>Course Title:</b> Production Technology of Winter Season Vegetable Crops	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS103	2	0	0	2

## Learning Outcomes

On the completion of the course the students will be able to

1. Identify deficiency symptoms of nutrients in winter vegetable crops.
2. Acquaint with winter vegetable crops growing in a vegetable garden, their
3. Cultural practices and identification
4. Know about the preparation of land for cultivation of vegetable crops.
5. Gain knowledge about innovative nursery raising technique for winter vegetable crops for raising quality and disease-free seedlings.
6. Schedule the cropping scheme for successful cultivation of Winter season vegetables

## Course Content

### Unit-1

7

1. Introduction, nutritional value, origin, botany and taxonomy, important countries and states growing vegetables along with area, climate and soil requirements of winter vegetables.

### Unit-2

8

1. 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 of winter vegetables.

### Unit-3

7

1. Physiological disorders, harvesting techniques, post-harvest management, plant protection measures and seed production of potato of winter vegetables.

### Unit-4

8

1. Cultivation of cole crops; cabbage, cauliflower, knoll-khol, broccoli, brussels sprout, chinese cabbage, root crops; carrot, radish, turnip, beet root, bulb crops; onion and garlic, peas and beans, green leafy cool season 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**

1. Swarup, V. 2006. Vegetable Science and Technology In India: Kalyani Publishers, India. Pp 656.
2. Kabir, J., Maity, T. K., Bose, T. K. 2002. Vegetable Crops Vol. 1: Naya Prokash, India. Pp 668.
3. Kabir, J., Maity, T. K., Bose, T. K. 2002. Vegetable Crops Vol. 2: Naya Prokash, India. Pp 489
4. Kabir, J., Maity, T. K., Bose, T. K. 2003. Vegetable Crops Vol. 3: Naya Prokash, India. Pp 550

<b>Course Title:</b> Breeding of Self Pollinated and Vegetative Propagated Vegetable Crops	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS105	2	0	0	2

### Learning Outcomes

On the completion of the course the students 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 vegetables
5. Use basic biometric techniques in computation of various parameters of Self-pollinated vegetables

### Course Content

#### Unit-1

5

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

#### Unit-2

6

1. 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-3

7

1. Demonstration of sib-mating and mixed population.

#### Unit-4

12

1. 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**

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

<b>Course Title:</b> Breeding of Cross Pollinated Vegetable Crops				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS107	2	0	0	2

### Learning Outcomes

On the completion of the course the students will be able to

1. Have knowledge about principles and practices adopted for breeding of Cross pollinated vegetable crops
2. Get acquainted about floral biology of cross pollinated vegetable crops
3. Impart knowledge about different methods of breeding followed for breeding of
4. Cross pollinated vegetable crops
5. Know about their mechanism of improved variety developed through breeding in cross pollinated vegetables.
6. Use basic biometric genetics in computation of various parameters of Cross-pollinated vegetables

### Course Content

#### Unit-1

**6**

1. 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

**7**

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

#### Unit-3

**7**

1. 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

**10**

1. 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**

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

<b>Course Title:</b> Systematic of Vegetable Crops	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS109	2	0	0	2

### Learning Outcomes

On the completion of the course the students will be able to

- 1 Know about morphological, cytological and molecular taxonomy of vegetable crops and their evolution.
- 2 Impart knowledge of different species of vegetable crops
- 3 Have knowledge about classification of vegetable crops
- 4 Impart knowledge about the history and distribution of vegetable crops.
- 5 Have the knowledge about the domestication of vegetables

### Course Content

#### Unit-1

5

1. Principles of classification, different methods of classification, salient features of international code of nomenclature of vegetable crops.

#### Unit-2

7

1. Origin, history, evolution and distribution of vegetable crops, botanical description of families, genera and species covering self and cross pollinated vegetable crops viz. brinjal, chilli, tomato, muskmelon, water melon, bottle gourd, cucumber, bitter melon, onion, cabbage, cauliflower, carrot, radish, turnip, amaranth, palak, peas, beans, okra

#### Unit-3

5

1. Vegetatively propagated vegetables like potato, garlic, sweet potato and spices (turmeric, coriander)

#### Unit-4

13

1. Cytological level of various vegetable crops, descriptive blanks for describing various varieties of important 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 Readings**

1. Kole, C. 2011. Wild Crop Relatives: Genomic and Breeding Resources: Vegetables. Springer Berlin Heidelberg, Germany. Pp 282
2. Munir, M., Khan, M. A., Ahmad, M. 2011. Wild Edible Fruits and Vegetables. Lap Lambert Academic Publishing GmbH KG, Germany. Pp 224.
3. Srivastava, U., Mahajan, R.K., Gangopadhyay, K.K., Singh, M. and Dhillon, B. S. (2001). Minimal descriptors of agri-horticultural crops. Part II: Vegetable Crops. National Bureau of Plant Genetic Resources, New Delhi, India. Pp 262.

<b>Course Title:</b> Post Harvest Handling of Vegetable Crops	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS111	2	0	0	2

### Learning Outcomes

On the completion of the course the students will be able to

- 1 Know about principles and practices of processing of vegetable crops.
- 2 Attain the knowledge about grading of vegetable crops
- 3 Have knowledge about packaging and storage of vegetable crops
- 4 Understand the workspace, tool and equipment design for PHTand cold chain Management.
- 5 Understand about the preparation of value added products of vegetables

### Course Content

#### Unit-1

**8**

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

#### Unit-2

**8**

1. 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, ripening of vegetables.

#### Unit-3

**7**

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.

#### Unit-4

**7**

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

1. Singh, B. and Singh, S. 2018 Advances in Postharvest Technologies of Vegetable Crops. Apple Academic Press., United States. Pp 558.
2. John, P Jacob. 2008. A handbook on post-harvest management of fruits and vegetables. Daya Publishing House, India. Pp 147
3. Sharma, S. (2010). Postharvest Management and Processing of Fruits and Vegetables: Instant Notes. NIPA, India. Pp 416.

<b>Course Title:</b> Principles of Plant Breeding.	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS113	2	0	0	2

### Learning Outcomes

On the completion of the course the students will be able to

- 1 Describe sources and types of genetic variation and explain their importance for Vegetable improvement
- 2 Locate, analyses, evaluate and synthesize information relevant to plant breeding
- 3 Judge which plant breeding methods are appropriate for specific objectives and situations.
- 4 Carry out specific plant breeding activities, such as selection of parental germplasm, observation and recording of phenotypic variation and selection among progeny
- 5 Understand genetic consequences of different plant reproductive systems

### Course Content

#### Unit-1

8

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

#### Unit-2

7

Genetic basis of breeding self- and cross-pollinated crops, Mating systems and response to selection. Pureline theory. Breeding methods in self-, cross-pollinated and asexually reproducing crops. Heterosis and inbreeding. Concept of plant ideotype.

#### Unit-3

5

Transgressive breeding. Hybrid breeding. Self-incompatibility and male sterility in crop plants and their commercial exploitation. Mutation breeding.

**Unit-4**

**5**

Breeding for abiotic and biotic stresses. Testing, release and notification of varieties. Maintenance breeding. Participatory Plant Breeding.

**Unit-5**

**5**

Plant Breeders' Rights and regulations for plant variety protection and farmers' rights.

**Transaction Mode**

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

**Suggested Readings**

1. Singh, B. 2018. Plant Breeding: Principles and Methods. Kalyani Publishers, India. Pp 884.
2. Chahal, G. S., Gosal, S. S. 2002. Principles and procedures of plant breeding: biotechnological and conventional approaches. CRC Press, India. Pp 604
3. Singh, P., 2013. Essentials of Plant Breeding. Kalyanai publishers, India. Pp 504

**Transaction Mode**

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

**Suggested Readings**

1. Kang M.S. 2020 Quantitative Genetics, Genomics and Plant Breeding. CABI, United Kingdom. Pp 416
2. Weber, E., Wricke, G.1986. Quantitative Genetics and Selection in Plant Breeding. W. de Gruyter, Germany. Pp 406
3. Sharma, J. R. 2006. Statistical and Biometrical Techniques in Plant Breeding. New Age International, India: Pp 432

<b>Course Title:</b> Principles of quantitative Genetics	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS115	2	0	0	2

4. Singh, P. 2009. Biometrical Techniques in Plant Breeding. Kalyani Publishers, India. Pp 343

### Learning Outcomes

On the completion of the course the students will be able to

- 1 Impart knowledge in the field of biochemistry as applied to breeding population, Provinces and making experiment in Vegetable genetics and Vegetable breeding
- 2 Attain knowledge about different experimental designs followed in field of Vegetable research.
- 3 Study about the knowledge and computation skills regarding component of Variation and variances scales.
- 4 Impart knowledge about different mating designs
- 5 Describe importance of different genetic parameters in crop improvement

### Course Content

#### Unit-1

7

Mendelian traits *vs* polygenic traits. Quantitative traits and their inheritance. Multiple factor hypothesis. Nature of gene action, epistatic and linkage effects.

#### Unit-2

6

Analysis of Variance and variance components. ANOVA. Biplot analysis. Comparison of means and variances for significance. Designs for experiments.

#### Unit III

7

Genetic diversity analysis. Association analysis. Path analysis and parent-progeny regression analysis.

#### Unit IV

5

Discriminant function and principal component analyses. Selection indices. Heritability and genetic advance. Generation mean analysis.

**Unit V**

**5**

Mating designs. Genotype x environment interaction. Stability parameters. AMMI analysis—principles and interpretation. QTL mapping. Marker assisted selection (MAS).

**Transaction Mode**

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

**Suggested Readings**

Kang M.S. 2020 Quantitative Genetics, Genomics and Plant Breeding. CABI, United Kingdom. Pp 416

2. Weber, E., Wricke, G. 1986. Quantitative Genetics and Selection in Plant Breeding. W. de Gruyter, Germany. Pp 406

3. Sharma, J. R. 2006. Statistical and Biometrical Techniques in Plant Breeding. New Age International, India: Pp 432

4. Singh, P. 2009. Biometrical Techniques in Plant Breeding. Kalyani Publishers, India. Pp 343

<b>Course Title:</b> Production Technology of Under Exploited Vegetable Crops				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS117	2	0	0	2

### Learning Outcomes

On the completion of the course the students will be able to

- 1 Know about the production technology of underutilized vegetable crops.
- 2 Learn about the cultivation and management of vegetable crops that are underexploited.
- 3 Identify deficiency symptoms of nutrients in under exploited vegetable crops and their solutions
- 4 Impart knowledge of innovative nursery raising techniques for vegetable crops for raising quality, disease, pest and harvesting induces
- 5 Know about different physiological disorders of under exploited vegetables and can control different insect pests and diseases.

### Course Content

#### Unit-1

7

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, postharvest management, plant protection measures and seed production of asparagus, artichoke, leek, Brussels sprout, chinese cabbage, broccoli,

#### Unit-2

7

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



kale, amaranth, celery, parsley, parsnip, lettuce, rhubarb, spinach, basella, bathu (chenopods),

**Unit-3**

**8**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, postharvest management, plant protection measures and seed production of elephant foot, yam, lima bean, winged bean, vegetable pigeon pea, jackbean, sword bean, spinegourd,

**Unit-4**

**8**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, postharvest management, plant protection measures and seed production of pointed gourd, oriental pickling melon and little gourd (kundru).

**Transaction Mode**

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

**Suggested Readings**

Pandey, A. K. 2008. Underutilized Vegetable Crops. Satish Serial Publishing House, India. Pp 366

2. Bhat, K.L. 2007. Minor Vegetables Un-Tapped Potential. Kalyani Publishers, India. Pp 296.

3. Sanwal, S. K. 2008. Underutilized Vegetable & Spices Crops. Agrobios, India. Pp 334

<b>Course Title:</b> Soil Fertility and Fertilizer Use	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS118	2	0	0	2

### Learning Outcomes

On the completion of the course the students will be able to

1. Understand the basics concept of soil fertility and soil Productivity.
2. Attain knowledge of different types of nutrients sources and their type from major to minor.
3. Examine the soil based on soil testing methods, its analysis and reclamation according to fruit crop
4. Learn the management and availability of micro and macro nutrients along with their transformation.
5. Provide knowledge about the sources and characteristics of nutrients for maintaining the soil health.

### Course content

#### Unit-1

**6**

Soil fertility and soil productivity. Nutrient sources - fertilizers and manures. Soil N - sources and N transformations. Biological nitrogen fixation. Nitrogenous fertilizers - their fate in soils and enhancing N use efficiency.

#### Unit-2

**8**

Soil P - forms, reactions in soils and factors affecting availability. Management of P fertilizers. Potassium- forms, mechanism of fixation, Q/I relationships. Management of K fertilizers. Sulphur, Ca and Mg - source, forms, fertilizers and their behaviour in soils and management.

**Unit-3**

**8**

Micronutrients- critical limits in soils and plants, factors affecting their availability, sources and management. Common soil test methods for fertilizer recommendations. Site-specific and plant need based nutrient management. Integrated nutrient management.

**Unit-4**

**8**

Blanket fertilizer recommendations- usefulness and limitations. Soil fertility evaluation. Soil quality in relation to sustainable agriculture.

**Transaction Mode**

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

**Suggested Readings**

1. ISSS. 2009. *Fundamentals of Soil Science*. 2nd Ed. Indian Society of Soil Science, New Delhi- 110 012. pp. 728.
2. Das D. K. 2011. *Introductory Soil Science*, 3rd revised and Enlarged Ed, Kalyani Publisher, Ludhiana. pp. 645.
3. Brady, N. C. 2016. *The Nature and Properties of Soils*. 15th edition Publisher: Pearson Education, ISBN: 978-0133254488
4. Daji J A; Daji J A; Kadam J R; Patil N D.1996. *Textbook of Soil Science* Bombay Media Promoters and publishers Pvt. Ltd.
5. Biswas, T.D.; Mukherjee, S.K.. 1995. *Text Book of Soil Science* 2nd sEd. Tata McGraw Hill Publisher, Delhi pp 433.

<b>Course Title:</b> Agriculture Statistics	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b>	3	0	0	3

### Learning Outcomes

On the completion of the course the students 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 Helps to develop decision making, agriculture development and estimates agriculture and national income
- 4 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
- 5 Acquire knowledge about land utilization and irrigation including the net area sown gross cultivated area, current follow, cultivable waste

### Course Content

<b>Unit-1</b>	<b>15</b>
Frequency distribution, standard error and deviation, correlation and regression analyses, co-efficient of variation.	
<b>Unit-2</b>	<b>10</b>
Hypothesis testing. Concept of p-value. Tests of significance-t, F and chi-square ( $X^2$ )	
<b>Unit-3</b>	<b>10</b>

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**

10

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**

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

<b>Course Title:</b> Seminar-I	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS125		0	1	1

**Learning Outcomes:**

On successful completion of this course, the students will 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
- 5 To ask appropriate questions, use evidence to support claims, respond to a range of questions

**Course Content**

Seminar topic will be suggested by faculty

**Course Title: Seminar II**

**Course Code: MFS126**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
0	0	1	1

**Learning Outcomes:**

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

<b>Course Title:</b> Lab-Production technology of Summer season Vegetable crops				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS102		0	2	1

- 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
- 5 To ask appropriate questions, use evidence to support claims, respond to a range of questions

### Learning Outcomes:

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

- 1 Know about the different roles of nutrients, fertigation and growth regulators and methods of weed control in summer season vegetables
- 2 Gain practical knowledge about different methods of hybrid seed production and seed extraction summer season vegetables.
- 3 Identify different diseases in summer season vegetable crops and their control.
- 4 Acquaint with different methods of summer season vegetable production specially by forcing techniques.

### Course Content

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

<b>Course Title:</b> Lab-Production technology of Winter season Vegetable crops				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:</b> MVS104		0	2	1

**Learning Outcomes:**

On successful completion of this course, the students will able

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

- 1 Know about raising winter season vegetables by different methods of irrigation and Mulching
- 2 Asses the quality of winter season vegetables
- 3 Have knowledge about different cropping schemes on commercial vegetable farms
- 4 Gain knowledge about efficient use of fertilizers and pesticides
- 5 Describe the problems associated with flowering and fruit set during cultivation of Winter season vegetables.

**Course Content**

1. Study of nutrient deficiency symptoms.
2. Experiments on improved water use efficiency through mulching and different irrigation methods.
3. Different methods of weed control and herbicide sprays.
4. Preparation of cropping scheme for commercial farms.
5. Quality evaluation for carotene, protein and ascorbic acid.



<b>Course Title: Lab- Breeding of Self Pollinated and Vegetative Propagated Vegetable Crops</b>				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:MVS106</b>		0	2	1

6. Visit to an established vegetable farm in the region.

### Learning Outcomes:

On successful completion of this course, the students will able

- 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 vegetables
- 5 Use basic biometric techniques in computation of various parameters of Self-pollinated vegetables

### Course Content

Selection of desirable plants from breeding population.

1. Observations and analysis of various qualitative and quantitative traits using germplasm, hybrids and segregating generations.
2. Observations and analysis of various quantitative traits using germplasm, hybrids and segregating generations
3. Induction of flowering.
4. Selfing and crossing techniques in vegetable crops.

5. Crossing techniques in vegetable crops
6. Hybrid seed production of vegetable crops in bulk.
7. Screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops.
8. Demonstration of sib-mating and mixed population.
9. Molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques.

### **Learning Outcomes:**

On successful completion of this course, the students will able

1. To educate the students about selection of parents for breeding in cross pollinated vegetables.
2. To educate the students about the Different method of breeding i.e. is selfing and crossing in vegetable crops
3. To educate the students about the various biometrical techniques use for quantitative and qualitative analysis.

### **Course Contents**

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.

<b>Course Title: Lab- Systematics of Vegetable Crops and Vegetative Propagated Vegetable Crops</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code: MVS110</b>	<b>L</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Course Code: MVS108</b>		0	2	1

### Learning Outcomes:

On successful completion of this course, the students will able

- 1 Learn about the Classification and maintenance of species and varieties of different vegetables
- 2 Know how about the Survey and collection of genera and species of vegetable those are available locally.
- 3 Get know about the preparation and importance of herbarium in systematic of vegetable crops.
- 4 Know about the origin and domestication of different species of vegetable crops
- 5 Have the knowledge about the domestication of vegetables

### Course Content

1. Identification of vegetable species and varieties
2. Description of vegetable species and varieties
3. Classification and maintenance of vegetable species and varieties.
4. Survey, collection of allied species and genera locally available.
5. Preparation of keys to the specie sand varieties.
6. Methods of preparation of her barium and specimens.

<b>Course Title: Lab- Post Harvest Handling of Vegetable Crops</b>				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:MVS112</b>		0	2	1

### **Learning Outcomes:**

On successful completion of this course, the students will able

- 1 Attain knowledge and Importance of the maturity indices of vegetables and methods and tools used for harvesting
- 2 Know about the different methods of enhancing shelf life of vegetables.
- 3 Impart the knowledge about precooling and storage of vegetables
- 4 Calculate respiration rate of harvested produce
- 5 Understand about the preparation of value-added products of vegetables

### **Course Content**

1. Practices in judging the maturity of vegetables, harvesting methods and tools.
2. Practices in harvesting methods and tools of vegetables.
3. Methods used for pre-cooling and their efficiency measurements.
4. Post-harvest chemical treatments to extend shelf life.
5. Sorting and grading methods.

6. Ripening techniques used in climacteric vegetables.
7. Traditional and latest safe storage techniques.
8. Respiration measurements in harvested produce.
9. Field visit to post-harvest and processing industry.

<b>Course Title: Lab- Principles of Plant Breeding</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:MVS114</b>		0	2	1

<b>Course Title: Lab- Principles of Quantitative Genetics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:MVS116</b>		0	2	1

### **Learning Outcomes:**

On successful completion of this course, the students will able

- 1 Learn about Different biometrical techniques used for analysis in quantitative genetics
- 2 Attain knowledge about the QTL mapping and its importance in vegetable breeding
- 3 Learn the construction of linkage maps.
- 4 Learn about laying of experimental designs practically
- 5 Analyse different genetic parameters in crop improvement

### **Course Content**

1. Multiple factors inheritance.
2. Partitioning of variance.
3. Heritability and genetic advance.

4. Covariance analysis.
5. Metroglyph analysis.
6. D2 analysis, cluster diagrams and dendrograms.
7. Correlation analysis. Path analysis. Parent progeny regression analysis. Diallel analysis NCD.
8. Line tester analysis.
9. Generation mean analysis.
10. QTL mapping.
11. Bi-parental mating and Triple Test Cross Stability analysis.
12. AMMI model.
13. Principal component analysis.
14. Biplots and mapping genotypes.
15. Construction of saturated linkage maps.

<b>Course Title: Lab- Soil Fertility and Fertilizer Use</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:MVS119</b>		0	2	1

### **Learning Outcomes:**

On successful completion of this course, the students will able

- 1 Acquire the basic knowledge regarding the laboratory and green house experiment and evaluation of indices of nutrient availability.
- 2 Acquire the knowledge about calculation of critical values of nutrients in soil and plants.
- 3 Determine the total and available nutrients in soils.
- 4 Attain expertise in skill development regarding analysis of nutrients in plants
- 5 Provide knowledge about the sources and characteristics of nutrients for maintaining the soil health.

### **Course content**

1. Laboratory and greenhouse experiments for evaluation of indices of nutrient availability
2. Laboratory and greenhouse experiments for their critical values in soils and plants.



<b>Course Title: Lab- Agricultural Statistics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:MVS121</b>	0	0	2	1

3. Chemical analysis of soil for total and available nutrients.
4. Analysis of plants for essential elements.

### **Learning Outcomes:**

On successful completion of this course, the students will able

- 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 Hepls to develop decision making, agriculture development and estimates agriculture and national income
- 4 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
- 5 Acquire knowledge about land utilization and irrigation including the net area sown gross cultivated area, current follow, cultivable waste

<b>Course Title: Lab- Fundamentals of Computer Applications</b>				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:MVS122</b>	0	0	2	1 (NC)

**Course Content**

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.

**Learning Outcomes:**

On successful completion of this course, the students will able

- 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.
- 5 Students will be able to synthesize and integrate material from primary and secondary sources with their own ideas in research papers.

## **Course Content**

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

<b>Course Title: Lab- Library and Information Services</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:MVS123</b>	0	0	2	1(NC)

### **Learning Outcomes:**

On successful completion of this course, the students will able

- 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 Identify keywords, synonyms and related terms in order to flexibly
- 5 Effectively search information resources

### **Course 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.

<b>Course Title: Lab- Technical Writing and Communication Skills</b>				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Course Code:MVS124</b>	0	0	2	1(NC)

### **Learning Outcomes:**

On successful completion of this course, the students will able

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- 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 Understand the basic components of definitions, descriptions, process explanations, and other common forms of technical writing
- 5 Familiarise with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation

### **Course 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, material and methods, experimental results and discussion; writing of abstracts, summaries, precis, citations etc.
3. Commonly used abbreviations in the theses and research communications
4. Illustrations, photographs and drawings with suitable captions; paginations, numbering of tables and illustrations
5. Writing of numbers and dates in scientific write-ups; editing and proof reading; writing a review article, access methods.

**Course Title: Master Research**  
**Course Code: MVS127**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
NA	NA	NA	24NC

Total Hours-300

**Learning Outcomes:** On successful completion of this course, the students will 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.

**Course Title: Tropical & Dryland Fruit Production**  
**Course Code: MFS101**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
2	0	0	2

**Total Hours-30**

**Learning Outcomes:** After successful completion of the course, the students will be able to:

- 1 Acquire the basic knowledge of root-stocks, scion varieties and propagation techniques of Tropical and dry land fruit crops.
- 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 and harvesting of tropical and dry land fruit crops.
- 4 Have the knowledge of storage marketing, post-harvest technology with knowhow of export and industrial potential.
- 5 Examine the physiology of tropical and dryland fruits.

### **Course content**

#### **Unit I**

**8**

Origin, distribution, commercial importance and export potential. Eco-physiological requirements. Species and varieties. Rootstocks and propagation. Planting, root zone, training and pruning.

#### **Unit II**

**7**



Nutrition and water requirements, fertigation, role of bio-regulators, major pests, diseases, physiological disorders and their control measures.

**Unit III****7**

Abiotic factors limiting fruit production. Flowering, pollination and fruit set. Quality improvement. Storage and ripening techniques.

**Unit IV****8**

Industrial and export potential, Agri. Expert Zones (AEZ) and industrial support. Fruit crops- citrus, mango, papaya, pineapple, banana, avocado, sapota, guava, ber, amla, jack fruit, annonas and minor fruits of tropics.

**Suggested Readings**

1. Chadha, K. L. 2012. Hand Book of Horticulture. ICAR, New Delhi. pp. 1057.
2. Paull, R. E. and Duarte, O. 2012. Tropical Fruits. Volume 2. 2<sup>nd</sup> edition CABI UK. pp.303.
3. Chattopadhyay, T.K. A textbook on Pomology.2015. Volume 3. Kalyani Publishers. pp.348.

**Course Title: Sub-Tropical and Temperate Fruit Production**

**Course Code: MFS103**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
2	0	0	2

**Total Hours-30**

**Learning Outcomes:** After successful completion of the course, the students 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 Understand the methodology of training, pruning, quality improvement, pollination, fruit set and plant protection of sub-tropical and temperate fruits.
- 5 Examine the physiology of tropical and temperate fruits.

**Course content**

<b>Unit I</b>	<b>8</b>
Origin, distribution, commercial importance and export potential. Eco-physiological requirements. Species and varieties. Rootstocks and propagation. Planting, root zone, training and pruning.	
<b>Unit II</b>	<b>7</b>
Nutrition and water requirements, fertigation, role of bio-regulators, major pests, diseases, physiological disorders and their control measures.	
<b>Unit III</b>	<b>7</b>
Abiotic factors limiting fruit production. Flowering, pollination and fruit set. Quality improvement. Storage and ripening techniques.	
<b>Unit IV</b>	<b>8</b>
Industrial and export potential, Agri. Expert Zones (AEZ) and industrial support. Fruit crops- Apple, pear, quince, grapes, plum, peach, apricot, cherries, hazelnut, litchi, loquat, persimmon. Kiwifruit, strawberry, walnut, almond, pistachio, pecan, mangosteen, carambola, bael, wood apple, fig, jamun, rambutan and pomegranate.	

**Suggested readings**

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

**Course Title: Lab- Tropical & Dryland Fruit Production.**

**Course Code: MFS102**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
0	0	2	1

**Total Hours-15**

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

- 1 Acquire the knowledge of economic importance, uses distribution and soil, climatic requirement, root-stocks, scion varieties and propagation techniques of Tropical and dry land fruit crops.

- 2 Learn the technical know for cultivation, plant protection measures, biotic and abiotic factors limiting tropical fruit production.
- 3 Study the importance and types of flowering, pollination, fruit set and fruiting and harvesting of tropical and dry land fruit crops.
- 4 Learn the significance of storage marketing, post-harvest technology with knowhow of export and industrial potential.
- 5 Examine the physiology of tropical and dryland fruits.

**Course content**

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

**Suggested readings**

1. Chadha, K. L. 2012. Hand Book of Horticulture. ICAR, New Delhi. pp. 1057.
2. Paull, R. E. and Duarte, O. 2012. Tropical Fruits. Volume 2. 2<sup>nd</sup> edition CABI UK. pp.303.
3. Chattopadhyay, T.K. A textbook on Pomology.2015. Volume 3. Kalyani Publishers. pp.348.

**Course Title: Lab-Sub- tropical and Temperate Fruit Production.**

**Course Code: MFS104**

L	T	P	Credits
0	0	2	1

**Total Hours-15**

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

- 1 Learn the importance, uses, origin, distribution, area and production of subtropical and temperate fruit crops.
- 2 Acquire the technical know-how regarding soil, climatic, water quality, biotic/abiotic factors limiting fruit production.
- 3 Get expertise in planting, root stock, propagation, fruit growth and development, fertigation, fertilization, nutrient and water management etc.

- 4 Learn the methods and techniques of training, pruning, quality improvement, pollination, fruit set and plant protection of sub tropical and temperate fruit production.
- 5 Examine the physiology of tropical and temperate fruits.

**Course content**

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