

SHIVAJI UNIVERSITY, KOLHAPUR



“A++” Re accredited by
NAAC (2021) with
CGPA3.52

Faculty of Interdisciplinary Studies

Structure, Scheme and Syllabus for

Bachelor of Vocational (B. Voc.)

Horticulture Science And Technology

Part II- Sem. III & IV

(Subject to the modifications that will be made from time to time)

Choice Based Credit System (CBCS) w.e.f. 2021-2022.

1. COURSE INFORMATION

Ministry of HRD, Government of India has introduced Entrepreneurship oriented Skill development courses of B.Voc./M.voc. courses. These courses will be run by NSQF approved institutes by using available infrastructure and facilities. In these courses the institute will conduct general education content and sector specific skills will be imparted by Skill Knowledge Providers/ Training Providers/ Industries.

During the three year duration of 'Horticulture Science And technology' a candidate is trained on professional skill, professional knowledge and Employability skill related to job role. In addition to this a candidate is entrusted to undertake project work, extracurricular activities and on job training to build up confidence. The broad components covered under Professional Skill subject are as below:-

During the three year duration the trainee learns about agro-meteorology, importance of different elements of weather & climate of agriculture, farm power and machinery, types and application of farm power, farm electricity, agricultural implements, basic knowledge on plant biology, Renewable energy, Soil properties, concept of formation of soil moisture and its conservation, role of organic matter in soil and its recycling water and their management, Soil fertility, fertilizers, manures & management of soil fertility and productivity, Introductory horticulture, fundamentals of horticultures, Importance and scope of horticulture, classification of horticultural plants etc. plant tissue culture techniques . The trainee learns about importance of fruits, flowers and vegetables, distribution of area production and productivity of fruits, vegetables and flowers, present situation and scope of development of horticultural crops, schemes on horticultural development, layout of plots and gardens, planning for home gardens, landscape gardens, experimental designs, fruit culture, vegetable propagation, cultivation of fruits & vegetables and its preservation, management of orchards, present situation of cultivation of different fruits, Vegetative propagation, different methods of vegetative propagation of fruits and flowers. cultivation of vegetables & spices, present situation in the cultivation of different vegetable crops, cultivation of flowers, climbers, foliages & other crops, cultivation of mushroom, care and management of potted plants, pest management, classes of insect pests diseases, integrated pest management, Seed production, marketing & trade management, quality of seeds and classification of seeds, Inventory control & maintenance of records, markets and marketing, trade and trading, methods of management of store, types of market, export of products etc.

2. Training scheme

The (NSQF) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of NSQF. Horticulture Science and Technology with variants and Apprenticeship Training Scheme (ATS) are two pioneer schemes of NSQF for strengthening vocational training.

'Horticulture Science and Technology' is one of the popular courses delivered nationwide through network of NSQF. The course is of three years duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill & knowledge and life skills. After passing out the training program at every level the trainee is awarded by Certificate given by college and university which is recognized worldwide.

Candidates require broadly demonstrating that they are competent to:

1. Read and interpret technical parameters/ documents, plan and organize work processes, identify necessary materials and tools;
2. Perform task with due consideration to safety rules, accident prevention regulations and

environmental protection stipulations; Apply professional skill, knowledge & employability skills while performing jobs.

3. Document the technical parameters related to the task undertaken.

2.1 Development pathways

1. Can join as Horticultural consultants, Horticultural technician, Plant Care Worker, Nursery Staffer, Pest Management, Horticultural Inspector, Gardener, General, Nurseryman, Planter.
2. Can become Entrepreneur in the related field.
3. Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate(NAC).
4. Can join Master Degree (Vocational) courses under NSQF as applicable.

3. LEARNING OUTCOME

Learning outcomes are an expression of total competencies of a learner and assessment will be carried out as per the assessment criteria.

LEARNING OUTCOMES (TRADE SPECIFIC)

1. Recognize metrological instruments and the miscellany within the vocation of horticulture subsequent safety precautions.
2. Preparation and organize life cycles of plants, scope of horticulture and introduction to fruits, flowers & vegetables.
3. Categorize fruits and vegetables based on season and edible parts.
4. Set up agro-meteorology instruments, scrutinize metrological information and document the data.
5. Classify, select and maintain different farm power machinery.
6. Evaluate physical and chemical properties of soil, soil pH, different methods and ingredient use for correction of Acid soil.
7. Arrange, install and use different irrigation systems, Water lifting systems and water quality assessment systems.
8. Identify diverse types of soil, methods of soil sampling and collection, study on soil physical characters, know soil test reports and different soil correction methods.
9. Study soil water holding capacity, Different methods and ingredients used for correction of Saline soil. Field visit for identification of soil troubles.
10. Plan and implement different soil correction method through drainage and agronomic practices.
11. Determine soil fertility and apply soil fertility management for enhancement of fertility of soil.
12. To concern Integrated Nutrient Management System (INMS) in the field.
13. Identify, set up and apply Bio-fertilizers.

14. Recognize the role of major and minor plant nutrients and its deficiency symptoms.
15. Produce special types of fruits, vegetables and flowers as per the requirements.
16. Use appropriate various cultivation techniques & methods to fruit crops & vegetable farms.
17. Preparation and implement different garden layouts and designs.
18. Identify and select different Vegetative propagation method & utilization of plant hormones.
19. Apply propagation techniques viz cutting, grafting, budding and layering.
20. Process and preserve vegetables and fruits using different techniques to prepare jam, jelly, squash, sauce, pickle, ketchup etc. its preservation and storage.
21. Develop the Cultivation techniques of different vegetables and spice crops.
22. Perform Floriculture and cultivation techniques for different Flowers, Climbers, Foliages and Medicinal plants to decorate.
23. Perform Cultivation of wild seasonal herbaceous flowering plants, wild tuberous plants, Betel Vine and Mushroom farming.
24. Apply Pest Management and control the Pest and Diseases of Horticultural Crops.
25. Use techniques of Seed Production, Processing and Packaging.
26. Maintain the records viz. Inventory Control, Maintenance of Records and Store management.
27. Conduct Market Survey and follow the legal requirement for trading as part of entrepreneurship development.
28. Develop the tissue culture techniques of different wild ornamental edible fruit and aromatic and medicinal plants.

JOB ROLE

Gardener, General; (Mali General) grows flowers, trees, shrubs, seedlings, vegetables, etc. in public or private gardens. Prepares soil and sows seeds, plants, seedlings etc. Waters seed-beds and growing plants. Weeds and hoes garden and prunes hedges and bushes. Sprays and dusts pesticides and evolves other measures to protect plants from diseases and wild animals. Prepares soil and lays lawn. Waters mows and levels lawns. Prepares paths and ensures their proper up-keep. Collects and preserves seeds for sowing. Supervises labourers engaged for assistance. Keeps implements etc. in good working order. May maintain green house for display. May cultivate vegetables and fruit trees. May specialize in ornamental gardening. May work in nursery for improving variety of plants from seeds, cuttings, grafting or budding and be designated as MALI, NURSERY. May sell plants, buy seeds, fertilizers, insecticides, etc. May pay wages to labourers employed.

Nurseryman; Mali, Nursery manages nursery on own account, or on behalf of employer to grow trees, plants, flowers, shrubs, creepers, seeds, bulbs etc. in open air or green houses for sale to customers. Decides kind and number of plants to be grown and method of planting, cultivating and treatment based on soil, climatic conditions, irrigation facilities etc. Selects and purchases seeds, fertilizers, insecticide. Equipment and machinery and other items. Plans preparation of beds and method of planting, depending on type of plants to be grown. Prepares bed by various processes such as breaking soil, mixing fertilizers, etc. sows seeds, plants, seedlings, cuttings or propagates plants by grafting, budding and other methods and makes water channels. Watches growth of sapling, seedlings, grafts and plants. Hoes and prunes excess growth and off-shoots of plants, dusts and sprays pesticides and takes other measures to protect plants from pets, wild animals, etc. Observes development of plants. Develops methods of grafting and budding./ Collects and preserves seeds for sale. Hires labour if necessary and undertakes planting, weeding, pruning etc. as required. Supervises their work and trains them. Maintains buildings and equipment in good condition.

Keeps records of cost and production statement. Sells seedling, seeds, bulbs etc. May specialize in landscape planting.

Planter; manages plantation on own account to grow plantation crops such as tea, coffee, rubber, etc. Arranges to procure seed according to type of crop such as tea, coffee, rubber, etc. Determines kinds of crop to be grown. Gets land cleared and prepared for growing crops by digging, ploughing, harrowing etc. Organizes and supervises various farm operations, sowing, manuring, weeding, spraying insecticide, and protection of crop from destruction by wild animals. Arranges harvesting of crop and supervises plucking, tapping and threshing of leaves, etc. Ensures proper maintenance and development of plantation estate. Maintains records relating to cost of production, sale and other accounts. May conduct research and organize demonstration. May arrange preservation of produce and partially process them prior to marketing. Is designated as Planter, Tea; Planter, Coffee; Planter, Cinchona; Planter, Cocoa; Planter, Rubber according to type of crop grown.

Key Features: Objectives

- i) To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- ii) To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- iii) To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- iv) To integrate NSQF within the undergraduate level of higher education to enhance employability of the students and meet industry requirements. Such student apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- v) To provide vertical mobility to students admitted in such vocational courses.

The certification levels will lead to Diploma/Advanced Diploma/B. Voc. Degree in Industrial Tool Manufacturing and will be offered by respective affiliating University.

Students may be awarded Level Certificate/Diploma/Advance Diploma /Degree as out-lined in the Table below:

Award	Duration after class X II	Corresponding NSQF level
Certificate	Sixth month	5
Diploma	1 Year	6
Advance Diploma	2 Year	7
B.Voc. Degree	3 Year	8

Course Structure

The course will consist of combination of practice, theory and hands on skills in the Capital Goods Sector.

Curriculum

The curriculum in each of the years of the programme would be a suitable mix of general education and skill development components.

Skill Development Components:

The focus of skill development components shall be to equip students with appropriate knowledge, practice and attitude, to become work ready. The skill development components will be relevant to the industry as per its requirements.

The curriculum will necessarily embed within itself, National Occupational Standards (NOSs) of specific job roles within the industry. This would enable the students to meet the learning outcomes specified in the NOSs.

The overall design of the skill development component along with the job roles selected will be such that it leads to a comprehensive specialization in few domains.

The curriculum will focus on work-readiness skills in each of the year of training.

Adequate attention will be given in curriculum design to practical work, on the job training, development of student portfolios and project work. Industrial Tool Manufacturing

A] Ordinance and Regulations: (As applicable to Degree vocational Course)

B] Shivaji University, Kolhapur

Syllabus For Bachelor vocational course in Horticulture Science and technology

1. TITLE: Subject- Horticulture Science and technology

Under the Faculty of interdisciplinary studies

2. YEAR OF IMPLEMENTATION:- Syllabi will be implemented from June 2020 onwards.

3. PREAMBLE:-

[Note :-The Adhoc Board of Studies should briefly mention foundation, core and applied components of the course/paper. The student should get into the prime objectives and expected level of study with required outcome in terms of basic and advance knowledge at examination level.]

4. DURATION

B. Voc. Part I, II and III (Three Years)

B. Voc. Part I - Diploma (One Year)

B. Voc. Part II - Advanced Diploma (Second Year)

B. Voc. Part III- Degree (Third Year)

5.STRUCTURE OF COURSE :

B. Voc. Part – I, II and III

Two Semester Per Year

One general Papers per year / semester

One elective course paper per semester

Three Core course papers /Vocational Papers per semester

Five Practical papers per semester

One Project / Industry Visit/ Study Tour / Survey/Internship/Hands on training.

7. INTAKE CAPACITY :

50 Students

6. SCHEME OF EXAMINATION

Evaluation System: The evaluation system will be the same as followed by the Shivaji University, Kolhapur. This course is consists of a six semester and shall have a weight age for Internal Exams and for term end exams. **The achieved marks and percentage shall be conversion as determined below.**

Grades and Grade Points

Letter Grade	Grade Points
O (Outstanding)	10
A+ (Excellence)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

Theory Examination– Attends of semester as per Shivaji University rules.

A) THEORY

The theory examination shall be at the end of the each semester. All the general theory shall carry 50marks, elective and vocational theory papers shall carry 50marks. Evaluation of the performance of the students in theory shall be on the basis of semester examination as mentioned above. The question paper will be set in the view of entire syllabus preferably covering each unit of the syllabus.

Nature of question paper for Theory examination (Excluding Business Communication Paper)–

Q.1 Multiple choice (10)	10 mks
Q.2 Long answer type (any two) out of three	20 mks
Q.3 Write short notes (any four) out of six	20 mks

B) PRACTICAL Each semester there will be external practical examination attendant of semester.

Evaluation of the performance of the students in practical shall be on the basis of semester examination .

Communication skill 10 mks

Each paper having separate practical (EC/CC) 50 mks

C) Project /field visit/ internship/fieldwork/Hands on training. 50 mks

Standard of Passing:

As per the guidelines and rules for B. Voc. (Attached Separately – Annexure I)

7. FEE STRUCTURE:

As per Government/University rules.

1. Refer website of concern affiliated college/institute to Shivaji University, Kolhapur.
2. Other fee will be applicable as per rules and norms of UGC and Shivaji University, Kolhapur.

8. ELIGIBILITY FOR ADMISSION:

As per guidelines obtained from UGC, NSQF and Shivaji University, Kolhapur by following rules and regarding reservations by Govt. of Maharashtra.

9. MEDIUM OF INSTRUCTION:

The medium of instruction shall be in English.

10. STRUCTURE OF COURSE- B. voc. Horticulture Science and Technology.

11. Eligibility for Admission : 10 + 2 from any faculty or equivalent Diploma /Advanced Diploma in any related stream.

12. Eligibility for Faculty : 1) M. Sc. (Horticulture/Botany) with NET / SET/ Ph.D.
2) M.A. (English) with NET/SET for Business Communication.

13. Eligibility for Laboratory Assistant cum clerk: B.Sc. (Horticulture/Botany) with MSCIT

14. Eligibility for Laboratory attendant cum gardener: Diploma in Horticulture.

15. Staffing Pattern:

Teaching:

In 1st Year of B. Voc. 1 Full Time and 1 Part Time Lecturer and 1 CHB Lecturer for Business communication. In 2nd Year of B. Voc. Total requirement of faculty (Inclusive of 1st Year) will be 3 Full time and 1 CHB Lecturer for Financial Accounting 1 CHB, Lecturer for Business Communication. 3rd Year of B. Voc. – Total requirement of faculty (Inclusive of 1st & 2nd Year) will be 4 Full time and 1 part time and 1 CHB Lecturer for Business Communication.

SHIVAJI UNIVERSITY, KOLHAPUR
STRUCTURE AND SYLLABUS OF B.VOC.
Bachelor of Vocational (B.Voc.) – Horticulture Science And Technology

Semester –III

Credits: 30

Course no.	Courses	Distribution of Marks			Credits			
		T	P	Project/Field visit/ Internship/ Field work	T	P	Project/Field visit/ Internship/ Field work	Total
BVHSTCS111	Economics and Marketing	40	10		3	2		5
BVHSTEC112	Growth and Development of Horticultural Crops	50	50		3	4		7
BVHSTCC 113	Tropical and Sub Tropical Fruits	50	50		3	3		6
BVHSTCC 114	Tropical and Sub Tropical Vegetables	50	50		3	3		6
BVHSTCC 115	Temperate vegetables, bulbous, and tuber crops	50	50		3	3		6
	Project/Field visit/ Internship/ Field work /Hands on training based on practical							
Total		240	210		15	15		30

Semester IV

Credits: 30

Course no.	Courses	Distribution of Marks			Credits			
		T	P	Project/Field visit/ Internship/ Field work	T	P	Project/Field visit/ Internship/ Field work	Total
BVHSTCS116	Information and Communication Technology	40	10		3	2		5
BVHSTEC117	Introduction to Plant Biotechnology	50	50		3	4		7
BVHSTCC 118	Seed Production of Vegetables, Tuber and Spice Crops	50	50		3	3		6
BVHSTCC 119		50	50		3	3		6
BVHSTCC 120	Principles and Methods of Plant Breeding and Horticulture Seed Production	50	50		3	3		6
	Project/Field visit/ Internship/ Field work /Hands on training based on practical							
Total		240	210		15	15		30

*BVHSTCS: Bachelor of Vocational Horticulture Science And Technology Communication Skill.

*BVHSTEC: Bachelor of Vocational Horticulture Science And Technology Elective Course.

*BVHSTCC: Bachelor of Vocational Horticulture Science And Technology Core course.

* T: Theory

* P: Practical

** Non credit courses must be completed as per guidelines of Shivaji University, Kolhapur.

SHIVAJI UNIVERSITY, KOLHAPUR
Bachelor of Vocational (B.Voc.) – Horticulture Science And Technology
Scheme of Teaching: B.Voc. - Part I and II Semester
Semester III

Course no.	Courses	Distribution of Work load (Per Week)	
		Theory	Practical
BVHSTCS 111	Economics and Marketing	4	2
BVHSTEC 112	Growth and Development of Horticultural Crops	5	4
BVHSTCC 113	Tropical and Sub Tropical Fruits	5	4
BVHSTCC 114	Tropical and Sub Tropical Vegetables	5	4
BVHSTCC 115	Temperate vegetables, bulbous and tuber crops	5	4
	Project/Field visit/ Internship/ Field work /Hands on training based on practical	-----	
Total		24	18

Semester IV

Course no.	Courses	Distribution of Work load(Per Week)	
		Theory	Practical
BVHSTCS 116	Information and Communication Technology	4	2
BVHSTEC 117	Introduction to Plant Biotechnology	5	4
BVHSTCC 118	Seed Production of Vegetables, Tuber and Spice Crops	5	4
BVHSTCC 119	Breeding and Seed Production of ornamental crops	5	4
BVHSTCC 120	Principles and Methods of Plant Breeding	5	4
	Project/Field visit/ Internship/ Field work /Hands on training based on practical	-----	
Total		24	18

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Semester III
Economics and Marketing
Course no. BVHSTCS111

Total Workload: 02 lectures per week of 50 min.

Distribution of Workload:

Theory: 04 lectures per week

Credits 3+2

Practical: 02 lectures per week per batch of 20 students

Objectives: i) To enable students – Economics in horticulture
ii) To enable students – Market and Marketing
iii) To enable students- preparation of project proposals

Module I: 9

Topics:

- 1.1 Economics: Meaning -Definition : Adam Smith, Marshall, Robbins Subject matter of Economics: Economic activities, (Wants, efforts satisfaction), Traditional view and modern view & approaches.
- 1.2 Basic terms, Goods (Classification, types) Utility - meaning -forms of utility, value, wealth and Price.
- 1.3 Consumption -Introduction, types of consumption, Engle's law, standard of living, factors affecting standard living, factors affecting consumption.

Module II: 10

Topics:

- 2.1 Supply- Introduction definition, Kinds of supply, Supply schedule, Law of Supply, Extension and contraction of supply, Increase & decrease of demand. supply, factors affecting supply.
- 2.3 Elasticity of supply – Meaning, elastic, inelastic supply, Measurement of elasticity of supply & its importance.
- 2.4 Production- Introduction, factors of production: Land, Labour, Capital & Management

Module III: 10

Topics:

- 3.1. Market and Marketing- meaning, definition, Role & scope of marketing.
- 3.2 Classification of Markets, Marketing and its functions.
- 3.3 Marketing channels- Introduction and types of marketing channels, price spread- meaning, marketing efficiency, constraints in marketing of Biotech Products.
- 3.4 Market intelligence and its importance

Module IV: 16

Topics:

- 4.1 Basic guidelines for preparation of project proposals-Introduction, overview of project, project description, technical and commercial feasibility, cost estimates, finance, financial feasibility, managerial aspects and project benefits.
- 4.2 Bank norms, insurance – Definition, meaning, its importance
- 4.3 SWOT- Analysis- Horticultural projects, Crisis management meaning and importance.

Reference books:

- 1.H L Ahuja. S. Chand and Company Limited. Advanced Economic Theory. Micro Economic Analysis.
- 2.Chandra P. 1984. Projects: Preparation, Appraisal & Implementation. McGraw Hill Inc.
- 3.Dewett, K.K. and Chand, A.1979. Modern Economic Theory. S.Chand and Co., New Delhi
- 4.Dewett, K.K. and Varma, J.D. 1986.Elementary Economics. S.Chand and Co., New Delhi.
- 5.Gupta RD & Lekhi RK. 1982. Elementary Economic Theory. Kalyani Publishers.
- 6.Kotler Philip and Armstrong.Principles of Marketing.Prentice-Hall.
- 7.Jhingan, M.L. 2012.Macro Economic Theory. Vrinda publishers, New Delhi .
- 8.Kotler Philip and Armstrong.Principles of Marketing.Prentice-Hall.
- 9.SS Acharya and N L Agarwal. 2005. Agricultural Marketing in India. Oxford and IBH Publishing Co. Pvt. Ltd
- 10.Sampat Mukherjee. 2002. Modern Economic Theory. New Age International.
Subba Reddy, S., Raghu ram, P., Neelakanta Sastry T.V., Bhavani Devi. I., 2010,
- 11.Agricultural Economics, Oxford & IBH Publishing Co. Private Limited, New Delhi
William J. Stanton. 1984. Fundamentals of Marketing. Tata McGraw-Hill Publication, New Delhi.
12. C.N. Sontakki. Marketing Management.Kalyani Publishers, New Delhi.
13. John Daniels, Lee Radebaugh, Brigham, Daniel Sullivan. International Business, 15th Ed., Pearson Education
14. Aswathappa.International Business. Tata McGraw-Hill Education, New Delhi
15. Francis Cherunilam. International Business: Text and Cases, 5th Ed. PHI Learning, New Delhi.
16. Prasanna Chandra. Projects. Tata McGraw-Hill Publication, New Delhi
17. John M. Nicholas. Project Management for Business and Technology – Principles and Practices. Pearson Prentice Hall
18. Harold Kerzner. Project Management – A System Approach to Planning, Scheduling, and Controlling.CBS Publishers & Distributors.
19. Prasanna Chandra. Projects – Planning, Analysis, Selection, Financing, Implementation, and Review. Tata McGraw-Hill Publishing Company Ltd.
- 20.P. Gopalakrishnan and V.E. Rama Moorthy. Textbook of Project Management. Macmillan.
- 21.Elementary Economic Theory by K K Dewett and Varma
- 22.Modern Economic Theory by K K Dewett
23. Agricultural Economics by Reddy S S , Raghuram, P. Neel Kanta Shastri
- 24.Agricultural Finance and Management by S. Subba Reddy, P. Raghuram
25. Agricultural Marketing in India by S.S. Acharya, N.L. Agrawal
- 26.Agricultural Project Management by S D Barde, K G Karmakar
27. e-reading: <http://ecourses.iasri.res.in/>

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Growth and Development of Horticultural Crops
Semester III
Course no. BVHSTEC112

Work Load: 09

Theory: 5 Lectures/Week

Practical: 4 Lectures/Week/Batch

Credits 03+04

Theory: 50 Marks

Practical: 50 Marks

Objectives: i) To enable students - Plant growth and development
ii) To enable students – Bioregulators
iii) To enable students-Physiology of flowering

Course content:

Module I

10

- 1.1 Theory- Plant growth and development – definition, components of growth and phases of growth in Horticultural Crops
- 1.2 Different stages of growth and growth curve.
- 1.3 Growth analysis of Horticultural Crops, crop development and dynamics (case studies of annual/perennial Horticultural Crops)
- 1.4 Leaf area index (LAI), optimum LAI in Horticultural Crops and canopy development

Module II

9

- 2.1 Photosynthetic productivity – Photosynthetic efficiency of C₃ and C₄ plants.
- 2.2 Translocation of assimilates – theories of translocation of organic solute, source and sink relationship.
- 2.3 Plant bioregulators – Auxins, gibberellins, cytokinin, ethylene , inhibitors and retardants, basic functions & biosynthesis.

Module III

10

- 3.1 Role of bioregulators in growth and development.
- 3.2 Role of bioregulators in propagation and flowering, fruit setting. Fruit thinning, fruit development, fruit drop and fruit ripening.
- 3.3 Photoperiodism – long day, short day and day neutral plant and vernalization and its application in Horticultural Crops

Module IV

16

- 4.1 Physiology of flowering, factors affecting flowering.
- 4.2 Training and pruning, physiological basis of training and pruning.
- 4.3 Physiology of fruit growth and development, fruit setting, factors affecting fruit setting and development.
- 4.4 Physiology of ripening fruit, climacteric and non-climacteric fruit, Physiology of fruits under post-harvest storage.
- 4.5 Physiology of fruit growth and development, fruit setting, factors affecting fruit setting and development.

References:

- 1.Salisbulry. 2007. *Plant Physiology*.CBS. New Delhi.
 - 2.Taiz, L. 2010.Plant Physiology. SINAUR. USA.
 - 3.Zeiger. 2003.Plant Physiology. PANIMA.New Delhi.UK.
 - 4.Delvin, R.M . 1986. Plant Physiology. CBS. Delhi.
 - 5.Richard, N. Arteca. 2004. Plant Growth Substances. CBS. New Delhi.
 - 6.Jacobs, W. P. 1979. Plant Hormones And Plant Development. Cambridge Univ. London.
 - 7.Basra, A. S. 2004. Plant Growth Regulators in Agriculture & Horticulture.HAWARTH press. New York.
 - 8.Noggle G.R and Fritz T.G. Introductory Plant Physiology
 - 9.Edward E. Durna. 2014. Principles Of Horticultural Physiology. CABI,
 - 10.Lincoln Taiz and Eduards Zeiger (5th Edition). Plant physiology
 - 11.Pandey and Sinha. Plant Physiology
 - 12.Carl fedtke. Biochemistry and Physiology of Herbicide Action
 - 13.Aswani pareek, S.K. Sopory, Hans Bohnert Govindjee. Abiotic stress adaptation in plants:
 - 14.Physiological, Molecular and Genomic foundation
 - 15.Horst Marschner, Mineral Nutrition of Higher plants
- e-reading:** <http://ecourses.iasri.res.in/>

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part –II
Horticulture Science and Technology
Semester III
Tropical and Sub Tropical Fruits
Course no. BVHSTCC113

Work Load-9

Theory: 5 Lectures/Week

Practical: 4 Lectures/Week/Batch

Credits: 3+3

Theory: 50 Marks

Practical: 50 Marks

Objectives: i) To enable students –fruit crops
ii) To enable students -packaging and storage fruits crops

Course content:

Theory

Module I

8

- 1.1 Scope and importance of fruit growing in India and Maharashtra
- 1.2 Horticultural classification of fruits including genome classification
- 1.3 Horticultural zones of India and Maharashtra

Module II

20

- 2.1 Study of following crops with reference to area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops.
- 2.2 Mango, Banana Grapes, Citrus Papaya, Sapota, Guava Pomegranate, Litchi, Pineapple Amla, Bael, Anona and Ber Fig, Jackfruit, Avocado and Mangosteen Carambola, Durian, Rambutan and Bilimbi Loquat and Rose apple, Breadfruit and Passion fruit. Special production problems in mango (Spongy tissue, Black tip, Malformation, etc and their control measures Bearing in mango, causes: Alternate and irregular bearing, control measures.

Module III

7

- 3.1 Citrus decline and casual factors and their management. Bud forecasting in grapes
- 3.2 Sex expression and seed production in papaya Latex extraction and crude papain production in papaya and economics of production Rain fed horticulture.

Module IV

10

- 4.1 Importance and scope of arid and semi-arid zones of India.
- 4.2 Characters and special adaptation of crops: ber, aonla, annona, jamun, wood apple, bael, pomegranate.
- 4.3 Characters and special adaptation of crops: Carissa, date palm, phalsa, fig, west Indian cherry and tamarind and Joint Agresco recommendations

References:

1. T.K. Chattopadhyay, 1997. *Text book on pomology*. Kalyani Publishers, New Delhi. udyog-Kolkata
2. Bose, T.K., Mitra, S.K. and Sanyal, D., 2002. *Tropical and Sub-Tropical-Vol-I*. Naya
3. Chadha, K.L. (ICAR) 2002, 2001. *Hand book of Horticulture*. ICAR, New Delhi.
4. Chundawat, B.S., 1990. *Arid fruit culture*. Oxford and IBH, New Delhi.
5. F.S. Davies and L.G. Albrigo, 2001. *Citrus*, Cab International.
6. H.P. Singh and M.M. Mustafa, 2009. *Banana-new innovations*. Westville Publishing House, New Delhi.
7. K.L. Chadda, 2009. *Advanced in Horticulture*. Malhotra Publishing House, New Delhi.
8. M.S. Ladaniya, 2013. *Citrus Fruits*. Elsevier, India post ltd, New Delhi
9. R.E. Litz, 2009. *The Mango* 2nd Edn. Cabi Publishing, Willingford, U.K.
10. Radha T and Mathew L., 2007. *Fruit crops*. New India Publishing Agency.
11. Rajput, CBS and Srihari babu, R., 1985. *Citriculture*. Kalyani Publishers, New Delhi.
12. S.P. Singh, 2004. *Commercial fruits*. Kalyani Publishers, New Delhi.
13. Symmonds, 1996. *Banana*. II Edn. Longman, London.
14. W.S. Dhillon, 2013. *Fruit Production in India*. Narendra Publishing House.
15. e-reading: <http://ecourses.iasri.res.in/>

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Semester III
Tropical and Sub Tropical Vegetables
Course no. BVHSTCC114

Work Load-9

Theory: 5 Lectures/Week

Practical: 4 Lectures/Week/Batch

Credits: 3+3

Theory: 50 Marks

Practical: 50 Marks

Objectives: To enable students –

1. To prepare students to successfully grow vegetables for commercial vegetable production
2. Be familiar with vegetable crops environmental modification.

Course content:

Theory

Module I

9

- 1.1 Introduction, scope and importance of vegetable.
- 1.2 Area, production, economic importance and export potential of tropical and Subtropical vegetables and tuber crops.
- 1.3 Types of vegetable farming.

Module II

13

- 2.1 Vegetable classification.
- 2.2 Description of varieties and hybrid, climate and soil requirements, seedrate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield, post-harvest handling, economics and marketing of
- 2.3 Tomato, chilli, brinjal, capsicum.

Module III

13

- 3.1 Description of varieties and hybrid, climate and soil requirements, seedrate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield, post-harvest handling, economics and marketing of
- 3.2 Okra, Cucumber, Pumpkin and squashes.
- 3.3 Bitter gourd, ridge gourd snake, gourd, bottle gourd, sponge gourd. Musk melon and water melon.

Module IV

10

- 4.1 Beans-French bean, cluster bean cowpea, yard long bean and dolichos bean
- 4.2 Leafy vegetables - Amaranthus, Mustard, Coriander, Methi.
- 4.3 Under exploited cucurbits - sweet gourd, pointed gourd, little gourd. Moringa and curry leaf, Agathi, Basella, Portulaca. Sorelle and Rooselle
- 4.4 Recommendations of joint Agresco.

References

1. B.R.Choudhary, 2009. *A Text book on production technology of vegetables*. Kalyani Publishers. Ludhiana.
 2. S. Thamburaj, 2014. *Text book of vegetable, tuber crops and Spices*. ICAR, New Delhi
 3. Choudhury, B. (ICAR). 1990. *Vegetables*. 8th edition, National Book Trust, New Delhi.
 4. Haldavnekar, P.C.; Parulekar, Y.R.; Mali, P.C. and Haldankar, P.M, 2015. *Vegetables – Production Technology*, Astral International.
 5. K S Yawalkar, 2008. *Vegetable crops in India*. Agri-Horticultural Pub. House. Nagpur. 2004
 6. K.L.Chadha, 1993. *Advances in Horticulture*. Malhotra publishing house. New Delhi
 7. K.V.Kamath, 2007. *Vegetable Crop Production*. Oxford Book Company. Jaipur
 8. M.K.Rana, 2008. *Olericulture in India*. Kalyani Publishers. Ludhiana
 9. M.S.Dhaliwal, 2008. *Handbook of Vegetable Crops*. Kalyani Publishers. Ludhiana
 10. Nath Prem, 1994. *Vegetables for the Tropical Regions*. ICAR New Delhi
 11. P.Hazra, 2011. *Modern Technology in Vegetable Production*. New India Publishing Agency. New Delhi.
 12. Pratibha Sharma, 2007. *Vegetable : Disease Diagnosis and Biomanagement*. Avishkar Publishers. Jaipur
 13. Premnath, Sundari Velayudhan and Singh, D.P., 1987. *Vegetables for the tropical region*. ICAR, New Delhi. Publishing Co. Pvt. Ltd, New Delhi.
 14. Shanmugavelu, K.G., 1989. *Production Technology of Vegetable Crops*. Oxford & IBH
 15. Singh, D.K., 2007. *Modern Vegetable varieties and production*. IBN publishers, Technology International Book Distributing Co, Lucknow.
 16. Singh, Umashankar, 2008. *Indian Vegetables*. Anmol Publications. Pvt.Ltd .New Delhi.
 17. T.K.Bose, 2002. *Vegetable Crops*. Nayaprakash. Kolkata
 18. T.R.Gopal Krishnan, 2007. *Vegetable Crops*. New India Publishing Agency. New Delhi.
- e-reading:** <http://ecourses.iasri.res.in/>

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Semester III
Temperate vegetables, bulbous, and tuber crops
Course no. BVHSTCC115

Work Load-9

Theory: 5 Lectures/Week

Practical: 4 Lectures/Week/Batch

Objectives: To enable students –

- i) Cool season vegetable crops
- ii) Scope and importance tuber crops
- iii) Nutritional importance of tuber crops

Course content:

Theory

Credits: 3+3

Theory: 50 Marks

Practical: 50 Marks

Module I

13

- 1.1 Scope and Importance of cool season vegetable crops in nutrition and National economy.
- 1.2 Area, production, export potential, description of Temperate Vegetables.
- 1.3 Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and marketing of Cabbage, Cauliflower, Sprouting Brocoli Chinese cabbage

Module II

7

- 2.1 Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and marketing of
- 2.2 Knol Khol Brussel's Sprout, Lettuce Pea, Broad Bean Palak, Spinach, coriander, fenugreek

Module III

12

- 3.1 Scope and importance tuber crops.
- 3.2 Nutritional importance of tuber crops.
- 3.3 Area, Production and export potential of various tuber crops, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, wate and nutrient ,weed management. Deficiencies and their management, Use of PGR'S and chemicals, Special intercultural operations, cropping system, Harvesting and yield. Economics of cultivation, Post-harvest handling, field and seed standards and marketing of Onion, Garlic, Radish, Carrot, Turnip, Beet root, Asparagus.

Module IV

13

- 4.1 Area, production, export potential, description of tuber crops.
- 4.2 Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and marketing of Sweet potato Cassava Colocasia Xanthosoma, Amorphophallus, Greater yam, Aerial Yam, Lesser yam, Jerusalem artichoke, Horse Raddish Yam bean, Arrow root and Chinesepotato and other under exploited tubers.

References:

1. B.R.Choudhary 2009.*A Text book on production technology of vegetables*. Kalyani Publishers. Ludhiana.
2. S. Thamburaj. 2014. *Text book of vegetable, tuber crops and Spices*. ICAR, New Delhi.
3. Bose, T.K. 2003. *Vegetable Crops*. Naya udyog publishers, Kolkata. 2002. Naya Prakash, Calcutta.
4. Choudhery, B., 1990. *Vegetables*. 8th edition. National Book Trust, New Delhi.
5. Haldavnekar, P.C.; Parulekar, Y.R.; Mali, P.C. and Haldankar, P.M, 2015. *Vegetables – Production Technology*, Astral International.
6. K S Yawalkar, 2004. *Vegetable crops in India*. Agri-Horticultural Pub. House. Nagpur.
7. K.L.Chadha. 1993. *Advances in Horticulture*. Malhotra publishing house. New Delhi
8. K.V.Kamath. 2007. *Vegetable Crop Production*. Oxford Book Company. Jaipur
9. M.K.Rana, 2008. *Olericulture in India*. Kalyani Publishers. Ludhiana
10. M.S.Dhaliwal, 2008. *Handbook of Vegetable Crops*. Kalyani Publishers. Ludhiana
11. Nath Prem. 1994. *Vegetables for the Tropical Regions*. ICAR New Delhi
12. P.Hazra. 2006. *Vegetable science*. Kalyani Publishers .Ludhiana
13. P.Hazra. 2011. *Modern Technology in Vegetable Production*. New India Publishing Agency. New Delhi.
14. Pratibha Sharma, 2007. *Vegetables: Disease Diagnosis and Biomanagement*. Avishkar Publishers. Jaipur
15. Prem Singh Arya, 1999. *Vegetable Seed Production Principles*. Kalyani Publishers, New Delhi.
16. Shanmugavelu, K.G. 1989. *Production technology of vegetable crops*. Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
17. Singh, Umashankar, 2008. *Indian Vegetables*. Anmol Publications. Pvt.Ltd. New Delhi.
18. T.K.Bose. 2002. *Vegetable Crops*. Nayaprakash. Kolkata
19. T.R.Gopal Krishnan, 2007. *Vegetable Crops*. New India Publishing Agency. New Delhi.
20. Uma Shankar. 2008. *Vegetable Pest Management Guide for Farmers*. International Book Distribution Co. Publication. Lucknow.

e-reading: <http://ecourses.iasri.res.in/>

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Semester III
Economics and Marketing
Practical: I
Course no. BVHSTCS111

Work Load:4

Practical: 2 Lectures/Week/Batch

Credits:02

Practical: 10 Marks

1. Techno-economic parameters for preparation of Horticultural Projects
2. Preparation of Bankable proposal for Horticultural projects
3. 4. To study different- marketing channels for different Horticultural Products.
- 5.6 To study price spread and producer's share in consumer's rupee, marketing cost & margin for different Horticultural Products.
7. To study the market structure
8. 9. . Visit to different market institutions (NAFED, APMC)
10. Visit to different market institutions (Marketing Society)
11. To study SWC, CWC & STC institution (History, objectives, functions & reference)
12. To study price behavior of Horticultural Products
13. To study the Producer's Surplus for different Horticultural Products.
14. Visit to various markets in the area Project/Field visit/ Internship/ Field work

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Semester III
Growth and Development of Horticultural Crops
Practical: II
Course no. BVHSTEC112

Work Load:4
Practical: 4 Lectures/Week/Batch

Credits:03
Practical: 50 Marks

1. Estimation of photosynthesis potential of hort. Crops by IRGA
2. Estimation of leaf area & leaf area index in hort. Crops
3. Studies on growth analysis- measurement of growth by using Arc indicator and auxanometer.
4. Measurement of growth by different growth analysis equations.
5. Determination of harvest index in different hort. Crops
6. Studies on preparation of hormonal solutions.
7. Identification and use of synthetic plant hormone and growth retardant, bioassay of plant hormone.
8. Studies on PGR in induction of rooting in cutting in hort. Crops.
9. Study of role of PGR in fruit ripening.
10. Study of role of PGR in control of flower drops.
11. Studies of important physiological disorder and their remedial measures in fruit & vegetables – I Macro elements
12. Studies of important physiological disorder and their remedial measures in fruit & vegetables –II- Microelements
13. Study of seed dormancy – causes and methods of breaking dormancy with chemicals & growth regulators,.
14. Study of seed viability testing
15. Study of germination – types of seed germination – factors affecting seed germination
16. Study of germination-methods of seed germination testing.
17. Project/Field visit/ Internship/ Field work /Hands on training

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Semester III
Tropical and Sub Tropical Fruits
Practical: III
Course no. BVHSTCC113

Work Load-4

Practical –4 Lectures/Week/Batch

Credits: 03

Practical: 50 Marks

1. Description and identification of varieties based on flower and fruit morphology in tropical crops.
2. Description and identification of varieties based on flower and fruit morphology in subtropical crops.
3. Training and pruning of grapes, mango, guava and citrus.
4. Selection of site and planting system
5. Pre-treatment of banana suckers, desuckering in banana.
6. Sex forms in papaya, seed production in papaya, latex extraction and preparation of crude papain.
7. Use of plastics in fruit production.
8. Visit to commercial orchards and diagnosis of maladies.
9. Manure and fertilizer application including bio-fertilizer in fruit crops
10. Preparation and application of growth regulators in banana, grapes and mango.
11. Ripening of fruits.
12. Grading and packaging,
13. Production economics for tropical and sub-tropical fruits.
14. Mapping of arid and semi-arid zones of India.
15. Botanical description and identification of ber, fig, jamun, pomegranate, carissa, phalsa.
16. Botanical description and identification of wood apple, West Indian cherry, tamarind, aonla, bael and annona.
17. Project/Field visit/ Internship/ Field work /Hands on training

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part –II
Horticulture Science and Technology
Semester III
Tropical and Sub Tropical Vegetables
Practical IV
Course no. BVHSTCC114

Work Load-4

Practical: 4 Lectures/Week/Batch

Credits: 03

Practical: 50 Marks

1. Identification of tropical vegetable crops.
2. Identification of subtropical vegetable crops
3. Raising vegetable seedlings of improved varieties.
5. Field preparation and lay out for vegetable crops.
6. Seed treatment and sowing of vegetable crops.
7. Planting and transplanting of vegetables crops
8. Integrated weed management in vegetables crops.
9. Methods of irrigation and manuring.
10. Use of plant growth regulators in vegetables production.
11. Identification of nutritional deficiencies in vegetables crops and remedies.
12. Identification of physiological disorders in vegetables crops.
13. Harvesting indices and maturity standards.
14. Harvesting of vegetables.
15. Packaging and storage of vegetable crops.
16. Project preparation and cost of cultivation of any two vegetables.

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part -II
Horticulture Science and Technology
Temperate vegetables, bulbous, and tuber crops
Semester III
Practical V
Course no. BVHSTCC115

Work Load-4

Credits: 03

Practical: Lectures/Week/Batch

Practical: 50 Marks

1. Identification and description of temperate vegetables and tuber crops.
2. Botanical description of temperate vegetables and tuber crops.
3. Identification and description of commercially important varieties of temperate vegetables.
4. Propagation methods, nursery management Raising seedlings of temperate Vegetables.
5. Use of Plant Growth Regulators in temperate vegetables
6. Land preparation and layout of planting and Transplanting of temperate vegetables.
7. Identification of physiological disorders in temperate vegetables and remedies.
8. Methods of irrigation, Manures and Fertilizer application vegetable and tuber crops.
9. Identification of nutritional deficiencies in temperate vegetables and and tuber crops their control measures
10. Maturity indices and harvesting of temperate vegetables, Packaging and storage of temperate vegetables.
11. Important Pest and diseases in vegetables and tuber crops.
12. Study of various propagation methods in tuber crops.
13. Field preparation and planting of Sweet potato, Potato, Amorphophallus, Colocasia
14. Study of maturity indices and harvesting and Post-harvest handling curing to storage of tuber crops.
15. Preparation of commercially viable project proposal.
16. Visit to vegetable, tuber research station/ vegetable market /farmers field.

SHIVAJI UNIVERSITY, KOLHAPUR
Bachelor of Vocational (B.Voc.): Horticulture Science And Technology
Scheme of Teaching: B.Voc. – Part-II

Semester IV

Credits: 30

Course no.	Courses	Distribution of Marks			Credits			
		T	P	Project/Field visit/ Internship/ Field work	T	P	Project/Field visit/ Internship/ Field work	Total
BVHSTCS116	Information and Communication Technology	40	10		3	2		5
BVHSTEC117	Introduction to Plant Biotechnology	40	50		3	4		7
BVHSTCC 118	Seed Production of Vegetables, Tuber and Spice Crops	40	50		3	3		6
BVHSTCC 119	Breeding and seed production of ornamental crops	40	50		3	3		6
BVHSTCC 120	Principles and Methods of Plant Breeding	40	50		3	3		6
	Project/Field visit/ Internship/ Field work /Hands on training based on practical							
Total		200	210		15	15		30

Course no.	Courses	Distribution of Work load (Per Week)	
		Theory	Practical
BVHSTCS 116	Information and Communication Technology	4	2
BVHSTEC 117	Introduction to Plant Biotechnology	5	4
BVHSTCC 118	Seed Production of Vegetables, Tuber and Spice Crops	5	4
BVHSTCC 119	Breeding and seed production of ornamental crops	5	4
BVHSTCC 120	Principles and Methods of Plant Breeding	5	4
	Project/Field visit/ Internship/ Field work /Hands on training based on practical	-----	
Total		24	18

***BVHSTCS: Bachelor of Vocational Horticulture Science And Technology Communication Skill.**

***BVHSTEC: Bachelor of Vocational Horticulture Science And Technology Elective Course.**

***BVHSTCC: Bachelor of Vocational Horticulture Science And Technology Core course.**

*** T: Theory**

*** P: Practical**

**** Non credit courses must be completed as per guidelines of Shivaji University, Kolhapur.**

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part -II
Horticulture Science and Technology
Information and Communication Technology
Course no. BVHSTCS116
Semester–IV

Distribution of Workload:

Credits 3+2

Theory: 04 lectures per week

Practical: 02 lectures per week per batch of 20 students

Modules Prescribed for Theory:

Objectives:

- i) To enable students to develop skills of the basic operations of a computer system.
- ii) To use computer applications software to solve problems.
- iii) To evaluate the object based classification with respect to urban land use and land cover

Module I

10

Introduction to Computer

- 1.1 Introduction, Characteristics, History & Evolution, Organization of Computers, Concept of Hardware & Software.
- 1.2 Applications of Computers in Various Fields, Computer Hardware and Software.
- 1.3 Computer Languages

Module II

11

MS- Office

- 2.1 Introduction to MS-Office
- 2.2 MS-word-Introduction, Menus, Shortcuts, Document types, working with Documents, formatting, creating tables, tools etc.
- 2.3 MS-Excel- Introduction, Spread sheet application, Menus, Tool bars and icons.
- 2.4 MS-Power Point (15) Introduction, Opening new presentation, Presentation templates, presentation layout, Creating Presentation.

Module III

12

Remote Sensing Application in Horticulture

- 3.1 Crop Identification, Crop production forecasting.
- 3.2 Horticulture, Cropping Systems Analysis, Soil mapping
- 3.3 Identification of planting and harvesting dates
- 3.4 Identification of pests and disease infestation
- 3.5 Irrigation monitoring and management

Module IV

Remote Sensing Application in Horticulture

12

- 4.1 Climate change monitoring
- 4.2 Water resources mapping
- 4.3 Collection of past and current weather data
- 4.4 Determination of water content of field crops
- 4.5 Crop health analysis

Reference Books:-

- 1) Remote Sensing: Techniques in Agriculture - D.D. Sahu
- 2) Applications of Remote Sensing in Agriculture - M. D. Steven, J. A. Clark
- 3) UAV or Drones for Remote Sensing Applications: Felipe Gonzalez Toro, Antonios Tsourdos
- 4) Microsoft Office 2010 Bible- WILEY.
- 5) Microsoft Office-Word 2007 inside out Microsoft Press Publication.
- 6) Microsoft Office-Excel 2007 inside out Microsoft Press Publication.
- 7) Computer Fundamentals by P.K. Sinha and Priti Sinha.
- 8) Computer fundamentals by Rajaraman.

SHIVAJI UNIVERSITY, KOLAPUR

B. Voc. Part-II

Horticulture Science and Technology

Introduction to Plant Biotechnology

Semester IV

Course no. BVHSTEC 117

Work Load-9

Theory: 4 Lectures/Week

Practical:4 Lectures/Week/Batch

Credits: 3+3

Theory: 50 Marks

Practical: 50 Marks

Objectives:

- i) To enable students about tissue culture
- ii) To enable students protoplast Culture
- iii) To enable students blotting techniques

Module I 10

- 1.1 History, scope and importance of Biotechnology in Crop Improvement
- 1.2 Plant Genetic Engineering, scope and importance in Crop Improvement
- 1.3 Totipotency and Morphogenesis, Definition, Importance of totipotency and morphogenesis.

Module II 10

- 2.1 Nutritional requirements of in-vitro cultures.
- 2.2 General techniques of tissue and cell culture.
- 2.3 Different composition of culture medium, components of tissue culture medium, importance of growth regulator in culture medium

Module III 13

- 3.1 Techniques of In-vitro cultures Types of culture, Micro-propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture.
- 3.2 Factors affecting above in-vitro culture; Factors affecting above invitro culture; Applications and Achievements.
- 3.3 Somaclonal variation, Introduction, causes, procedure and application in crop improvement. Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement.

Module IV 12

- 4.1 Somatic embryogenesis Types, direct and indirect embryogenesis, factors influencing somatic embryogenesis and synthetic seed production technology
- 4.2 Protoplast Culture, Introduction, method of protoplast fusion, selection of somatic hybrids and application of somatic hybridization.
- 4.3. Blotting techniques – Types, procedure, Application, advantages and disadvantages.

References:

1. Singh, B D, 2004. Biotechnology Expanding Horizons 2nd Edn. Kalyani Publishers, New Delhi.
 2. Gupta, P.K., 2015. Elements of Biotechnology 2nd Edn. Rastogi and Co., Meerut.
 3. Razdan M K, 2014. Introduction to plant Tissue Culture 2nd Edn. Science Publishers, inc. USA.
 4. Gautam V K, 2005. Agricultural Biotechnology. Sublime Publications
 5. Thomar, R.S., Parakhia, M.V., Patel, S.V. and Golakia, B.A., 2010. Molecular markers and Plant biotechnology, New Publishers, New Delhi.
 6. Purohit, S.S., 2004. A Laboratory Manual of Plant Biotechnology 2nd Edn. Agribios, India.
 7. Singh, B.D. 2012. Plant biotechnology. Kalyani publishers, Ludhiana
 8. Bilgrami, K.S. and Pandey, A.K. 1992. Introduction to biotechnology. CBS Pub. New Delhi
 9. Gupta, P.K. 1994. Elements of biotechnology. Rastogi Pub. Meerut.
 10. Chahal, G.S. and Gosal, S.S. 2003. Principles and procedures of plant approaches breeding
 11. Biotechnological and conventional. Narosa Publishing House, New Delhi.
- e-reading:** <http://ecourses.iasri.res.in/>

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part -II
Horticulture Science and Technology
Seed Production of Vegetables, Tuber and Spice Crops
Semester IV
Course no. BVHSTCC118

Work Load:8

Theory: 4 Lectures/Week

Practical:4 Lectures/Week/Batch

Credits: 3+4

Theory: 50 Marks

Practical: 50 Marks

Objectives:

To know the seed production

To know the types of seed

To know the germination, viability and purity

Module I

10

History of seed industry in India,

Definition of seed and difference between grain and seed and classes, types of seed

Importance and scope of seed production in india,

Principles of seed production

Module II

10

Role of climate (Light, humidity, temp. etc) on vegetable seed production.

Agencies of pollination and isolation distance in vegetable seed production.

Field standards and seed standards. Seed production methods in cole crops. (cabbage, cauliflower, knolkhol, broccoli)

Seed production methods in solanaceous crops (tomato, chilli, brinjal, Bell peper)

Module III

10

Seed production methods in cucurbits (cucumber, Bitter gourds, pumpkin, Watermelon)

Seed production methods in leafy vegetables (fenugreek, amaranthus, palak)

Seed production methods in beans and peas (pea, french bean, dolichos bean)

Module IV

15

Seed production methods in bulb crops (onion, garlic)

Seed production methods in tuber crops (potato, sweet potato)

Seed production in root vegetables (radish, carrot)

Seed production in seed spice crops(Coriander)

Seed extraction, drying, processing and storage of seed.

Seed testing for germination, viability and purity.

Seed act / legislation Recommendations of Joint Agresco.

Reference Books:

1. Agarwal, P. K. 2010. *Techniques in Seed Science and Technology*. South Asian
2. Agrawal R. L. 1999. *Seed Technology*. Oxford and IBH Publicity Company, New Delhi.
3. Arya, Prem Singh. 2003. *Vegetable seed Production Principles*. Kalyani Publishers.
4. Fageria, M. S. 2011. *Vegetable Crops- Breeding and Seed Production*. Kalyani
5. G.N. Kulkarni, 2002. *Principles of Seed Technology*. Kalyani Publishers, Ludhiana.
6. Geetharani, P. 2007. *Seed Technology in Horticultural Crops*. NPH Publications. Jodhpur.
7. Khare, D. and Bhole, M.S. 2000. *Seed Technology*. Scientific Publishers (India) Jodhpur.
8. L.O. Copeland, 1999. *Principles of Seed Science and Technology*. Springer Publications. Ludhiana.
9. N.P. Nema, 1988. *Principles of seed certification and Testing*. Allied Publications.
10. Nemgal Singh, P.K. Singh, Y.K. Singh and Virendrakumar, 2006. *Vegetable Seed Production Technology*. International book distributing co., Lucknow.
- 11 P. Hazra and M.G. Som, 2009. *Vegetable seed production and Hybrid Technology*. Kalyani Publishers, Ludhiana.
- 12 Prem Singh Arya, 2003. *Vegetable breeding, production and seed production*. Kalyani publishers, New Delhi.
- 13 Rattan Lal Agarwal, 1995. *Seed technology*. Oxford & IBH, New Delhi
- 14 [Raymond A.T.](#), 2000. *Vegetable Seed Production*. Oxford University Press, USA
15. Singh, Prabhakar. 2015. *Seed Production Technology of vegetable*. Daya Publishing House. New Delhi.
16. Singh, S.P. 2001. *Seed Production in Commercial Vegetables*. Agrotech Publishing Academy, Udaipur.
17. Vanangamudi, K. 2006. Natarajan, P. Srimathi, N. Natarajan, T. Saravanan, M. Bhaskaran, A. Bharathi, P. Nateshan, K. Malarkodi. *Advances in Seed Science*. Agrobios (India), Jodhpur.
- 18 Vanangamudi, K. 2010. *Vegetable Hybrid Seed Production and Management*. Agrobios. Jodhpur.

e-reading: <http://ecourses.iasri.res.in/>

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part -II
Horticulture Science and Technology
Breeding and seed production of ornamental crops
Semester IV
Course no. BVHSTCC 119

Work Load-9

Theory: 4 Lectures/Week

Practical: 4 Lectures/Week/Batch

Credits: 3+4

Theory: 50 Marks

Practical: 50 Marks

Objectives: i) To enable students – breeding of ornamental crops
ii) To enable students- seed production of ornamental crops

Module I **10**

- 1.1. Scope and importance of breeding of ornamental crops.
- 1.2 Objectives and techniques in ornamental plant breeding
- 1.3 Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental and flower crops.

Module II **15**

- 2.1 Rose
- 2.2 Jasmine, Hibiscus, Bouganvillea
- 2.3 Chrysanthemum, Gerbera, China Aster, Gaillardia, Dehlia, Zinnia,
- 2.4 Carnation, Marigold, Cosmos
- 2.5 Tuberose, Gladiolus, Lilium,
- 2.6 Orchid, Anthurium, Heliconia, Antirrhinium,
- 2.7 Petunia, Dianthus, Snapdragon, Pansy, Crossandra, Geranium Breeding for Pancratium disease resistance.

Module III **10**

- 3.1 Development of promising cultivars of important ornamentals and flower crops.
- 3.2 Role of heterosis and its exploitation
- 3.3 Production of F1 hybrids and utilization of male sterility.

Module IV **10**

- 4.1 Production of open pollinated seed.
- 4.2 Harvesting processing and storage of seeds
- 4.3 Seed certification.
- 4.4 Recommendations of Joint Agresco

References

1. Agarwal, P. K 1994. Principles of Seed Technology. ICAR Publication, New Delhi.
 2. Agarwal, R. L. 1996. Seed Technology. Oxford&IBH Publishers, New Delhi.
 3. Bhattacharjee, S.K. and L.C. De. 2003. *Advanced Commercial Floriculture*. Aavishkar Publishers, Distributors, Jaipur (Rajasthan) India.
 4. Bose, T. K., L.P. Yadav, P. Patil, P. Das and V.A. Partha Sarthy. 2003. *Commercial flowers*. Partha Sankar Basu, Nayaudyog, 206, Bidhan Sarani, Kolkata-700006.
 5. Callaway D.J. and M.B. Callaway. 2000. Breeding Ornamental Plants. Timber Press.
 6. Harding, J., F.Singh and J.N. Mol. 1991. Genetics and Breeding of Ornamental Species. Springer Publishers.
 7. Pal, B. P. 1966. *The Rose in India*. Directorate of Knowledge management in Agriculture, Indian council of Agriculture Research-New Delhi.
 8. Singh, B. D. 1983. Breeding Principles and Methods. Kalyani Publishers, New Delhi.
 9. Vainstein, A. 2002. Breeding for Ornamental: Classical and Molecular Approaches. Springer Publishers.
- e-reading: <http://ecourses.iasri.res.in/>

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Principles and Methods of Plant Breeding
Semester IV

Course no. BVHSTCC 120

Work Load-9

Theory: 4 Lectures/Week

Practical: 4 Lectures/Week/Batch

Objectives:–

Credits:3+3

Theory: 50 Marks

Practical: 50 Marks

1. To enable students to develop varieties with better characteristics in higher yield, Disease resistance, flood resistance.
2. To develop varieties with better characteristics in Early to mature, Resistance to alkaline and saline soil conditions, Better quality, Drought resistance.

Module I

10

- 1.1 Plant Breeding – Introduction, definition aims and objective.
- 1.2 Significance of Plant Breeding
- 1.3 Genetic basis for Plant Breeding classical, quantitative and molecular.
- 1.4 Plant Breeding in India- limitations, major achievement and goal setting for future.

Module II

12

- 2.1 Mode of reproduction-sexual reproduction.
- 2.2 Mode of pollination- self and cross pollination.
- 2.3 Mechanism of pollination control.
- 2.4 Genetic components of polygenic variation and Breeding strategies.
- 2.5 Selection of basis of crop breeding

Module III

13

- 3.1 Hybridization and goals of hybridization
- 3.2 Hybridization and selection of plants
- 3.3 Population developed by hybridization- Simple crosses
- 3.4 Population developed by hybridization- Bulk crosses
- 3.5 Population developed by hybridization- Complex crosses

Module IV

10

- 4.1 General and special Breeding techniques.
- 4.2 Heterosis- Concept and types
- 4.3 Heterosis- Estimation and genetic basis.
- 4.4 Male sterility and its significance

References:

1. B.D. Singh. *Plant breeding : principles and methods*. Kalyani Publishers, Ludhiana.
 2. D.S. Falconer. *Introduction to quantitative genetics*. Longman Scientific & Technical, Longman Group, UK, Ltd., England.
 3. G K Kallo. *Breeding of vegetables*. Panima publishers, New Delhi
 4. G. S. Chahal and S.S. Gosal. 2002. *Principles and Procedures of Plant Breeding*. Narosa Publishing House, New Delhi.
 5. Hays and Garber. *Breeding crop plants*. Mc Graw Hill Publications, New York
 6. J.R. Sharma. *Principles and practices of plant breeding*. Tata McGraw Publishing Company Ltd., New Delhi
 7. K. Mather and J.L Jinks. *Introduction to Biometrical genetics*. Chapman and Hall, London
 8. Phundan Singh. *Essentials of plant breeding*. Kalyani Publishers
 9. Poehlman, J.M. and Borthakar, D. 1995. *Breeding Asian Field Crops*. Oxford & IBH Publishing Co., New Delhi
 10. Pundan Singh. *Essentials of plant breeding*. Kalyani. India
 11. R.C. Chaudhary. *Plant Breeding*
 12. R.K. Singh and B.D. Chaudhary. *Biometrical methods in quantitative genetic analysis*. Kalyani Publishers, Ludhiana.
 13. R.W. Allard. *Principles of plant breeding*. John Wiley & Sons, New York.
 14. V.L. Chopra. *Plant breeding: Theory and Practice*. Oxford & IBH Publishing CO. Pvt. Ltd., New Delhi.
 15. W.R. Fehr. *Principles of cultivar development: theory and technique (Vol. 1)*. Macmillan Publishing Company, New York.
- e-reading:** <http://ecourses.iasri.res.in/>.

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part –II
Horticulture Science and Technology
Semester IV
Information and Communication Technology
Practical I
Course no. BVHSTEC116

Work Load-2

Practical: Lectures/Week/Batch

Credits: 02

Practical: 10 Marks

1. MS-Word - Creating & Editing Document. Formatting Document. Use of Auto-text, Autocorrect, Spelling and Grammar Tool. Page Formatting, Page Border, Background,
2. MS-Excel - Creating & Editing Worksheet, Fill Handle. Use Formulas and Functions. Preparing Charts
3. MS-PowerPoint - Creating, Manipulating & Enhancing Slides. Inserting Organizational Charts, Excel Charts. Using Word Art

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part II
Horticulture Science and Technology
Semester IV
Introduction to Plant Biotechnology
Practical II
Course no. BVHSTEC 117

Work Load-4

Practical: Lectures/Week/Batch

Credits: 03

Practical: 50 Marks

1. General instruction and laboratory methods.
2. Plant tissue culture laboratory organization.
3. Plant tissue culture laboratory equipments and their uses.
4. Dry, Heat and Wet Heat sterilization methods
5. Chemical sterilization, Filtration and UV irradiation.
6. Preparation of solutions
7. Preparation of tissue culture media and their composition
8. Establishment and maintenance of callus culture from different explants, sub culture of callus.
9. Production of embryogenic callus.
10. Indirect organogenesis: Production of shoots and roots from callus
11. Acclimatization and Hardening
12. Micropropagation with shoot apex culture in different plants (Banana)
13. Demonstration of Gene transfer techniques, direct methods and indirect methods;
14. Demonstration of Confirmation of Genetic transformation.
15. Demonstration of gel-electrophoresis techniques.
16. Visit to tissue culture laboratory/ Hands on training.

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Semester IV
Seed Production of Vegetables, Tuber And Spice crops
Practical III
Course no. BVHSTCC 118

Work Load-4

Practical: Lectures/Week/Batch

Credits:03

Practical: 50 Marks

1. Study of seed structure, size, shape etc.
2. Objectives and practices of field inspection.
3. Objectives and practices in rouging.
4. Seed sampling techniques and types of seed samples
5. Seed testing techniques for determination of percent germination, viability, purity.
6. Seed classes or types on the basis of physical and genetical purity
7. Harvesting, extraction, processing, drying of seeds.
8. Packaging, labelling and storage of Seeds.
9. Methods of seed production in cole crops.
10. Methods of seed production in root vegetables.
11. Methods of seed production in bulb crops.
12. Methods of seed production in solanaceous crops
13. Methods of seed production in cucurbitaceous crops.
14. Methods of seed production in leafy vegetables.
15. Methods of seed production in leguminous vegetables.
16. Visit to seed production plots, seed processing units and seed testing laboratory.

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part – II
Horticulture Science and Technology
Semester IV
Breeding and Seed Production of Ornamental crops
Practical III
Course no. BVHSTCC 119

Work Load-4

Practical: Lectures/Week/Batch

Credits:03

Practical: 50 Marks

1. Acquaintance with breeding tools for floricultural crops
2. Methods of emasculation and pollination, selfing
3. Study of floral biology and pollination of rose, jasmine, chrysanthemum, tuberose
4. Study of floral biology and pollination of gerbera, gladiolus, dahlia heliconia, lilium, gaillardia
5. Study of floral biology and pollination of petunia, hibiscus, bouganvillea, zinnia, cosmos
6. Study of floral biology and pollination of dianthus, snapdragon, pansy, crossandra, marigold, geranium
7. Study of floral biology and pollination of china aster, orchids, anthurium, carnation
8. Techniques of inducing polyploidy and mutation.
9. Production of pure and hybrid seeds rose, jasmine, chrysanthemum, tuberose
10. Production of pure and hybrid seeds gerbera, gladiolus, dahlia heliconia, lilium.
11. Production of pure and hybrid seeds petunia, hibiscus, bouganvillea, zinnia, cosmos
12. Production of pure and hybrid seeds china aster, orchids, anthurium, carnation
13. Harvesting, conditioning and testing of seeds
14. Practice in seed production methods.
15. Practice in seed production methods
- 16 Visit to seed production industry/ fieldvisit/project.

SHIVAJI UNIVERSITY, KOLAPUR
B. Voc. Part-II
Horticulture Science and Technology
Semester IV
Principles and Methods of Plant Breeding
Practical V
Course no. BVHSTCC 120

Work Load-4

Practical: Lectures/Week/Batch

Credits: 03

Practical: 50 Marks

1. Study of field equipments for plant breeders
2. Study selfing methods in plat breeding.
3. Study of floral biology and hybridization technique
- 4 Study Floral biology – its measurement.
5. study of methods of emasculation
6. study of crossing techniques in major crops.
7. Determination of mode of reproduction in crop plants, handling of breeding material, segregating generations (pedigree, bulk and back cross methods),
8. Field layout, and maintenance of experimental records in self and cross pollinated crops.
9. Demonstration of hybrid variation and production techniques.
10. Hardy Weinberg Law and calculation,
11. Male sterility studies in horticultural crops
12. Incompatibility studies in horticultural crops
13. Calculation of inbreeding depression
14. Calculation of heterosis, heterobeltioses
15. Computation of GCA, SCA,.
16. Computation of GA, heritability
17. Visit to breeding station/ Hands on training/ Field visit.