Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Vocational Pattern
(Faculty of Science & Technology)

SYBSc (Vocational)
SEED TECHNOLOGY

Choice Based Credit System Syllabus
To be implemented from Academic Year 2020-2021

Preamble:

Vocational Seed Technology is a three year degree course approved by Savitribai Phule Pune University taught at undergraduate level since 1995 under the Vocationalisation of first degree education scheme sanctioned by UGC. It is offered as one of the subject along with Botany, Zoology and Chemistry at the FYBSc level and among the three subjects (Seed Technology, Botany, Zoology) at SYBSc level. Two theory and one practical course (Seed Technology), along with four theory and two practical courses (Botany) are offered at the TYBSc level.

The course "Seed Technology" was introduced in 1995 only at Pravara Rural Education Society's Padmashri Vikhe Patil College of Arts, Science and Commerce, Pravaranagar and has fetched employment to most of the students in reputed seed industries. The course is coordinated and conducted by the Department of Botany of the college.

Introduction:

Seed Technology is a science dealing with the methods of improving genetic and physical characteristics of seed. Study of seed technology is necessary for two reasons. Firstly, the introduction of hybrids and high yielding varieties of crop plants of immense importance has necessitated great care in the maintenance and preservation of seed. Secondly, if seed production is to evolve as a prime enterprise, instead of a byproduct as it has been characteristically handled down through the centuries. Development of seed enterprise is absolutely necessary in the context of modern agriculture. It is the quickest way of increasing agricultural production. Much of our success in increasing food production has been due to the development of seed enterprise over the past decade. Seed demand at present is strong and expected to continue expanding.

Indian economy depends on agriculture and about 60 % of Indian population depends on agriculture. For quality production the farmers need quality seeds or propagating materials. Unless the farmer gets seeds, which are genetically pure and possess other desired qualities namely, high germination percentage and vigour, high purity, sound health etc. they cannot obtain the expected yields.

Quality material is provided to the farmers by the seed industries established throughout the country. These industries are in continuous demand for the knowledgeable, trained, talented Seed Technologists. These industries provide career opportunities to the graduate and post graduate students in the following ways:

- Management of seed enterprise (Govt./Semi govt. undertakings and private seed companies)
- State and Central Seed Testing Laboratories
- Seed Certification Agencies
- Seed Law Enforcement Agencies
- Training/Extension Centers
- Research Institutes

The course focuses on training of students in plant breeding, tissue culture, seed health testing techniques, testing for purity of seeds, crop improvement, protection and storage techniques. Seed technology is of prime importance because

- Seed is a carrier of new technologies
- Seed is a basic tool for secured food supply
- Seed is the principal means to secure crop yields in less favourable production areas

- Seed is a medium for rapid rehabilitation of agriculture in cases of natural disaster

The proposed syllabus lays more stress on practicals as compared to theory. It concentrates on experimental practice and theoretical aspects. This approach justifies the term 'vocational'.

The teaching centre at the college will develop trained manpower for the industries and employments will be generated. Students can also become entrepreneurs. Trained and competent teachers with experience in industry would be ideal to teach the subject. Besides such teachers, persons from industry could contribute to the course.

Objectives to be achieved:

- To promote the possibility of self employment after BSc / MSc Seed Technology
- To bridge up the gap between knowledge based conventional education and market demands and to provide an alternative to those pursuing higher education.
- To enrich students' training and knowledge that would be useful in the seed industry so that the farmers will get quality seeds
- To introduce the concepts of experimental design in Seed Technology
- To inculcate sense of job responsibilities, while maintaining social and environment awareness
- To help students build-up a progressive and successful career in industries with a biotechnological perspective

Course Outcomes:

- Through this course, skilled and technical human resources will be made available to the seed industries so that the farmers will get quality seeds
- Students will be acquainted with the fields like plant morphology, plant protection, plant pathology, seed entomology, plant biotechnology, plant breeding, seed production, seed processing, seed treatments, seed storage, seed marketing etc.
- It will develop self confident and knowledgeable personnel's.
- The course will motivate students in the field of research as well as guide to become a successful entrepreneur.
- It will develop self awareness to enrich decision making ability among the students.
- Personal development will increase the clarity and effectiveness in knowing themselves and their strengths.

Eligibility

1. First Year B.Sc.:

The basic qualification for FYBSc Vocational Seed Technology admission is that the student should have Higher Secondary School Certificate (10+2) or its equivalent Examination with subjects like English and Biology (Pure Science)/Crop Science/Crop Production/Horticulture/Dairy Science/Animal Husbandry. The student is supposed to take Botany, Zoology, Chemistry and Seed Technology as the subjects for the first year.

2. Second Year B.Sc.:

The students should qualify in all subjects at the FYBSc level or at least in ATKT as per the SPPU norms. In the second year the student is free to drop one subject either chemistry or Zoology.

3. Third Year B. Sc.:

The student should compulsorily clear all the subjects of First Year BSc Seed Technology and keep terms (at least ATKT) of Second Year of BSc with Seed Technology. Students who have passed in all subjects at the SYBSc level, but have not cleared all the courses at FYBSc level are not eligible for admission to the TYBSc. It is mandatory for the students to take Botany and Seed Technology as subjects in the third year.

Admissions are given as per the selection procedure / policies adopted by the respective college keeping in accordance with conditions laid down by the Savitribai Phule Pune University, Pune. Reservation and relaxation are as per the State Government rules.

Standard of Passing

i. In order to pass in the First Year Theory Examination, the candidate has to obtain at least 14 marks out of 35 (University Examination) and 6 marks out of 15 (Internal Examination) in each Theory Course per semester.
ii. In order to pass in the Second Year Theory Examination, the candidate has to obtain at least 14 marks out of 35 (University Examination) and 6 marks out of 15 (Internal Examination) in each Theory Course per semester.
iii. In order to pass in Practical Examination, the candidate has to obtain at least 14 marks out of 35 (University Practical Examination) and 6 marks out of 15 (Internal Practical Examination).

Award of Class/Grade: As per the SPPU norms

ATKT Rules: As per the SPPU norms

INFORMATION ABOUT THE VOCATIONAL COURSE-SEED TECHNOLOGY (Year wise)

Class	Semester	Paper and Code	Course Title	Credits
FYBSc	I	Paper-I (ST 1.1)	Morphology	2
		Paper-II (ST 1.2)	Plant Breeding and Testing for Cultivar Genuineness	2
		Practical Paper (ST 1.3)	Practicals Based on ST 1.1 and ST 1.2	2
	II	Paper-III (ST 1.4)	Seed Physiology	2
		Paper-IV (ST 1.5)	Seed Production	2
		Practical Paper (ST 1.6)	Practicals Based on ST 1.4 and ST 1.5	2
SYBSc	**III**	**Paper-I (ST 2.1)**	**Hybrid Seed Production**	**2**
		Paper-II (ST 2.2)	**Seed Testing**	**2**
		Practical Paper (ST 2.3)	**Practicals based on ST 2.1 and ST 2.2**	**2**
	IV	**Paper-III (ST 2.4)**	**Vegetable Seed Production**	**2**
		Paper-IV (ST 2.5)	**Seed Quality Control**	**2**
		Practical Paper (ST 2.6)	**Practicals based on ST 2.4 and ST 2.5**	**2**

EXAM PATTERN FOR VOCATIONAL SEED TECHNOLOGY COURSE PER SEMESTER

1. **FYBSc Seed Technology:**
   - **A. Theory**
     - Internal Exam : 15 M
     - Theory Exam : 35 M
     - Total : 50 M
     - Duration : 2 hours for theory and 40 minutes for internal exam
   - **B. Practical**
     - Internal Exam : 15 M
     - Practical Exam : 35 M
     - Total : 50 M
     - Duration : 4 hours

2. **SYBSc Seed Technology:**
   - **A. Theory**
     - Internal Exam : 15 M
     - Theory Exam : 35 M
     - Total : 50 M
     - Duration : 2 hours for theory and 40 minutes for internal exam
   - **B. Practical**
     - Internal Exam : 15 M
     - Practical Exam : 35 M
     - Total : 50 M
     - Duration : 4 hours

SYBSC SEED TECHNOLOGY (Revised 2020)

Semester III:
Paper-I (ST 2.1): Hybrid Seed Production (Credit.2)

CREDIT-I

Chapter-1: Introduction **1L**

- Definition
- Objectives
- Applications

Chapter-2: Heterosis and inbreeding depression **3L**

- Definition
- Genetic basis of Heterosis.
- Genetic basis of Inbreeding depression
- Commercial utilization

Chapter-3: Apomixis **3L**

- Definition
- Types of apomixes
- Significance

Chapter-4: Male sterility **5L**

- Definition,
- Types of male sterility
    - GMS - Introduction and its use in hybrid seed production
    - CMS- Introduction and its use in hybrid seed production
    - CGMS- Introduction, seed production of A,B and R-Lines

Chapter-5: Self- incompatibility **3L**

- Definition
- Types: Heteromorphic and Homomorphic system
- Measures to overcome self incompatibility
- Utilization in production of hybrids

CREDIT-II

Chapter-1: Devices for hybrid seed production **3L**

- Manual Emasculation and hand / insect pollination
- Use of genetic male sterility
- Use of Gametocides

Chapter-2: Basic principles of hybrid seed production **6L**

- Definition of variety and its type
- Selection of site for seed production
- Compact area approach
- Sowing, row spacing, fertilizer and irrigation
- Isolation, planting ratio and seed rate
- Rouging and pollen shedders

- Pollen viability
- Pollen storage
- Stigma receptivity

Chapter-3: Hybrid seed production of **6L**

- Maize
- Bajra
- Jowar
- Cotton
- Sunflower
- Groundnut with respect to following points
  - Source of seed
  - Selection of field (Land requirement)
  - Isolation distance
  - Sowing
  - Cultural practices (Fertigation, Irrigation, plant protection)
  - Rouging
  - Harvesting and threshing.

References:

- Handbook of Agriculture- *Indian Council of Agricultural Research, New Delhi*
- Plant breeding-B.D Singh, *Kalyani Publishers, New Delhi*
- Essentials of Plant Breeding- Phundan Singh, 2008
- Experimental Seed Science and Technology -Umarani et. *al.* 2006., *Agrobios, Jodhpur*
- Plant Breeding: Principles and Methods- Phundan Singh, 2009. *Kalyani Publishers, New Delhi*
- Seed Technology- Agrawal, 2005. *Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi*
- Principles of crop production-Reddy, 2008. *Kalyani Publishers, New Delhi*
- A text book of Botany- Pandey, 2010. *S. Chand and Company Ltd., New Delhi*
- College Botany- Santra and Chatterjee, 2007., *New Central Book Agency (P) Ltd., Kolkata*
- A Class book of Botany- Dutta, 1983., *Oxford University Press, Calcutta*

Semester III:
Paper-II (ST 2.2): Seed Testing (Credit.2)

CREDIT-I

Chapter-1: Introduction **2L**

- Definition
- Importance and history

Chapter-2: Organizations and Seed Testing **3L**

- International seed testing Association
- Association of Official Seed Analysts
- Central Seed Testing Laboratory
- State Seed Testing Laboratory

Chapter-3: Seed Testing Laboratory **3L**

- Introduction to ISTA
- Layout for seed testing laboratory
- Staff
- Equipments

Chapter-4: Seed Sampling **3L**

- Definition
- General Principles of Seed Sampling
- Tools/Equipments used for sampling
- Kinds and procedure of seed sampling.

Chapter-5: Receipt and Registration of Samples **4L**

- Types of seed samples (Service, Certification and Official sample),
- Precautions during registration of samples
- Procedure of registration
- Mixing and dividing samples
- Heterogeneity test

CREDIT-II

Chapter-1: Physical Purity Analysis **4L**

- Definition of purity components
- Physical Purity Work Board
- Procedure
- ODV test
- Reporting and results

Chapter-2: Moisture Testing **3L**

- Air oven method
- Universal OSAW Moisture Tester
- Digital Moisture Meter

Chapter-3: Germination testing **4L**

- Definition and objectives

- General principles and requirements
- Procedure and methods (Paper, Sand and Soil)
- Seedling evaluation (Normal Seedlings, Abnormal Seedlings, Multigerm Seed Units and Ungerminated Seeds)

Chapter-4: Seed Vigour Testing **2L**

- Definition
- Principle and General procedure

Chapter-5: Reporting the results and storage of guard samples **2L**

References:

- Handbook of Agriculture- *Indian Council of Agricultural Research, New Delhi*
- Plant breeding-B.D Singh, *Kalyani Publishers, New Delhi*
- Essentials of Plant Breeding- Phundan Singh, 2008
- Experimental Seed Science and Technology -Umarani et. *al.* 2006., *Agrobios, Jodhpur*
- Plant Breeding: Principles and Methods- Phundan Singh, 2009. *Kalyani Publishers, New Delhi*
- Seed Technology- Agrawal, 2005. *Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi*
- Principles of crop production-Reddy, 2008. *Kalyani Publishers, New Delhi*
- A text book of Botany- Pandey, 2010. *S. Chand and Company Ltd., New Delhi*
- College Botany- Santra and Chatterjee, 2007., *New Central Book Agency (P) Ltd., Kolkata*
- A Class book of Botany- Dutta, 1983., *Oxford University Press, Calcutta*

Semester IV:
Paper-III (ST 2.4): Vegetable Seed Production. (Credit.2)

CREDIT-I

Chapter-1: Vegetable Farming **2L**

- Introduction
- Types: Home or Kitchen garden, Market garden, Truck garden, Garden for Vegetable Processing, Vegetable Farming for Seed Production

Chapter-2: Introduction to Vegetable Seed Production **1L**

- Concept
- History and objectives

Chapter-3: Classification of vegetable crops **2L**

- Classification based on growing season
- Classification based on plant part used for consumption

Chapter-4: Vegetable Nursery Management **2L**

- Introduction
- Types of Nursery beds
    - Raised bed
    - Flat bed
    - Hi-tech Nursery and Soil less raising of seedlings
- Precautions in raising healthy seedlings
- Transplantation

Chapter-3: Hybridization techniques in Vegetable crops **2L**

- Introduction
- Objectives and types
- Procedure

Chapter-6: Breeding Methods in Vegetable crops **3L**

- Introduction
- Selection
    a) Pure line selection
    b) Pedigree selection
    c) Bulk method

Chapter-7: Population Improvement **3L**

- Introduction
- Objectives and methods
- Mass Selection
- Progeny Selection
- Application and achievements

CREDIT-II

Chapter-8: Routine of seed production **15L**

Seed production procedure in the plants- Brinjal, Tomato, Okra, Bitter guard and Onion with reference to

- Land requirement
- Isolation
- Nursery management
- Cultural practices
- Rouging
- Plant protection
- Harvesting
- Seed extraction method,
- Seed drying
- Storage

References:

- Vegetables-B. R. Choudhary, 2014. *Kalyani Publishers, New Delhi*
- Handbook of Agriculture- Indian Council of Agricultural Research, New Delhi
- Plant breeding-B.D Singh, Kalyani Publishers, New
- Delhi
- Essentials of Plant Breeding- Phundan Singh, 2008
- Experimental Seed Science and Technology -Umarani *et. al.* 2006., Agrobios, Jodhpur
- Plant Breeding: Principles and Methods- Phundan Singh, 2009. Kalyani Publishers, New Delhi
- Seed Technology- Agrawal, 2005. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
- Principles of crop production-Reddy, 2008. Kalyani Publishers, New Delhi

Semester IV:
Paper-IV (ST 2.5): Seed Quality Control. (Credit.2)

CREDIT-I

Chapter-1: Introduction **2L**

- Definition of Seed Quality
- Concept of seed quality control

Chapter-2: Seed certification **3L**

- Definition and Objectives
- Concept
- Classes of seed
- Phases of Seed Certification
- Procedure of seed certification

Chapter-3: Seed certification agencies and its organization **2L**

Chapter-4: Minimum seed certification standards **4L**

- General seed certification standards.
- Specific crop standards.

Chapter-5: Field inspection **4L**

- Objectives and general principles.
- Method of inspection.

CREDIT-II

Chapter-6: Seed legislation **3L**

- Introduction
- Types of seed legislation
- Seed legislation in India (Seed Act)

Chapter-7: Seed law enforcement **3L**

- Introduction
- Duties of seed inspector
- Powers of seed inspector
- Offenses and penalties
- Procedure of seed law enforcement

Chapter-8: Indian regulatory system in seed quality control **5L**

- International organizations and seed certification
- Statutory bodies and agencies established in India
    - Central seed committee
    - Central seed certification board
    - Central seed testing laboratory
    - State seed certification agency
    - State seed testing laboratory
    - Appellate authority

- Committee for recognition of seed certification agencies of foreign countries.

Chapter-9: Organic Farming **4L**

- Introduction
- Concept
- Organic manures, Vermi-compost and Green manures,
- Bio-fertilizers
- Biological Control, Bio-pesticides, Vermi-wash and Pheromones
- Trap crops, Bird perch

References:

- Handbook of Agriculture- Indian Council of Agricultural Research, New Delhi
- Experimental Seed Science and Technology -Umarani *et. al.* 2006., Agrobios, Jodhpur
- Seed Technology- Agrawal, 2005. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
- Handbook of Biological Control and Horticultural Crops Vol-1 and 2, 2015- J. S. Bohra, Agrotech Press, New Delhi
- Indian Insect Predators in Biological Control-K. Sahayaraj, 2004, Daya Publishing House, Delhi
- Quality Seed Production in Cotton- 2003, D. Kalavathi et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore
- Quality Seed Production in Oil Seed Crops- 2003, P. Balamurugan et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore
- Quality Seed Production in Pulses- 2003, K. Sivasubramaniam et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore
- Quality Seed Production in Rice and Millets- 2003, V. Krishnasamy et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore

Semester III:

Practical Paper (ST 2.3): Practical's based on Paper-I (ST 2.1) and Paper-II (ST 2.2) (Credits-2)

1. To study emasculation and pollination techniques in Maize and Cotton
2. To study protogynous and protandrous nature in Pearl millet and Sunflower
3. Identification of genetic male sterile plants at bud initiation stage and Laboratory method for confirmation of sterility in maize by aceto-carmine test under microscope
4. To study pollen viability and determination of percent pollen viability
5. To study Seed Sampling and Dividing Equipments
6. To study germination methods (Paper, Sand and Soil)
7. To study seed vigour
8. Physical purity analysis of seed sample
9. Moisture testing by Air Oven Method and Moisture Meter
10. Compulsory visit to Seed Testing Laboratory/Seed Industry

References:

- Handbook of Agriculture- *Indian Council of Agricultural Research, New Delhi*
- Plant breeding-B.D Singh, *Kalyani Publishers, New Delhi*
- Essentials of Plant Breeding- Phundan Singh, 2008
- Experimental Seed Science and Technology -Umarani et. *al.* 2006., *Agrobios, Jodhpur*
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- College Botany- Santra and Chatterjee, 2007., *New Central Book Agency (P) Ltd., Kolkata*
- A Class book of Botany- Dutta, 1983., *Oxford University Press, Calcutta*

Semester IV:

Practical Paper (ST 2.6): Practical's based on Paper-IV (ST 2.4) and Paper-V (ST 2.5) (Credits-2)

1. To study emasculation and pollination techniques in Brinjal/Tomato/Okra/Bitter guard/Onion
2. To study Seed extraction methods in Tomato and Brinjal
3. Hi-tech Nursery and Soil Less raising of Seedlings
4. Study of Minimum seed certification standards
5. To study Seed Certification Procedure
6. Taking of field counts and filling of inspection reports of important field crops
7. Study of important bio-fertilizers
8. Study of production of bio-pesticides
9. Study of trap crops
10. Visit to the Vegetable breeding farm/Seed Quality Control Laboratory/Bio-fertilizer Unit/Bio-pesticide Unit/Commercial Hi-tech Vegetable Nursery

References:

- Handbook of Agriculture- Indian Council of Agricultural Research, New Delhi
- Experimental Seed Science and Technology -Umarani *et. al.* 2006., Agrobios, Jodhpur
- Seed Technology- Agrawal, 2005. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
- Handbook of Biological Control and Horticultural Crops Vol-1 and 2, 2015- J. S. Bohra, Agrotech Press, New Delhi
- Indian Insect Predators in Biological Control-K. Sahayaraj, 2004, Daya Publishing House, Delhi
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- Quality Seed Production in Oil Seed Crops- 2003, P. Balamurugan et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore
- Quality Seed Production in Pulses- 2003, K. Sivasubramaniam et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore
- Quality Seed Production in Rice and Millets- 2003, V. Krishnasamy et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore