Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Vocational Program

Seed Technology

(Faculty of Science & Technology)

T.Y.B.Sc.

(Vocational course- Seed Technology)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2021-2022

Preamble:

Vocational Seed Technology is a three year degree course approved by Savitribai Phule Pune University taught at undergraduate level since 1995 under the Vocationalization 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, and 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 practical's 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, Second Year and Third 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 First Year, Second Year and Third Year 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) per semester

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
TYBSc	V	Paper-I (ST 3.1)	Seed Pathology and Entomology	2
		Paper-II (ST 3.2)	Entrepreneurship Development	2
		Practical Paper (ST 3.3)	Practicals based on ST 3.1 and ST 3.2	2
	VI	Paper-III (ST 3.4)	Seed Farm Management, Processing and Storage	2
		Paper-IV (ST 3.5)	Biotechnology and Intellectual Property Rights	2
		Practical Paper (ST 3.6)	Practicals based on ST 3.4 and ST 3.5	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 & 1/2 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 & 1/2 hours

3. TYBSc 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 & 1/2 hours

TYBSc Vocational Seed Technology
Semester V
Paper-I (ST 3.1): Seed Pathology and Entomology (Credit-02. 30 lectures)

CREDIT-I: Seed Pathology

Chapter-1: Introduction and History of Seed Pathology 4L

- Definition
- History of seed pathology
- Economic importance of seed pathology in seed industry and plant quarantine
- Important seed transmitted pathogens and their influence on seed production
- Mechanism of seed transmission and entry point of seed infection
- Influence of environmental factors on seed borne disease

Chapter-2: Seed Borne and Storage Fungi 4L

- Definition of seed borne and storage fungi
- Differences between seed borne and storage fungi
- Common seed borne fungi (Any two) with examples
- Common storage fungi (Any two) with examples

Chapter-3: Seed Borne Bacteria, Viruses and nematodes 3L

- Definition of Seed Borne Bacteria, Viruses and nematodes
- Impact of seed borne bacteria, viruses and nematodes on seeds or crop with suitable examples

Chapter-4: Seed Health 4L

- Definition of Seed Health and Seed Health Testing
- Importance of seed health and seed health testing
- Methods of Seed health testing
  - Visual inspection of dry seed
  - Microscopic examination
  - Washing test
  - Seed soak method
  - Incubation method
  - Growing on test (Seedling symptom test)
  - Staining test
  - Embryo count
  - Immunodiagnostic methods

CREDIT-II: Seed Entomology

Chapter-5: Introduction of Seed Entomology **2L**

- Definition
- History of insect pest
- Relation of insects and plants
- Insects as vector of plant diseases

Chapter-6: Important orders of insect pest **3L**

- Lepidoptera
- Diptera
- Hemiptera
- Isoptera
- Coleoptera

Chapter-7: Study of common Insect Pest **4L**

- Fibre crop – Boll worm/ Mites
- Pulses – Pod borer
- Cereals – Aphid/Army worm
- Vegetables – Thrips/White fly

(Study of above insect pest with respect to their lifecycle, way of infestation / damage, symptoms and control measures)

Chapter-8: Storage entomology **3L**

- Definition
- Introduction to storage entomology
- Pest problem in seed storage
- Stages of seed storage
- Study of any two storage pest with respect to their life cycle, way of infestation/damage, symptoms and control measures.

Chapter-9: Seed Storage Management **3L**

- Introduction
- Factors affecting seed storage
- Structures for seed storage
- Methods of protection and control of seed damage during storage
  - Seed treatment
  - Air conditioning
  - Dehumidification
  - Sanitation
  - Fumigation

References:

- Agarwal VK & Sinclair JB. 1997. Principles of Seed Pathology. Boca Raton.
- Karuna V. 2007. Seed Health Testing. Kalyani.
- Neergaard P. 1988. Seed Pathology. Mac Millan.
- Anonmyous, Hand Book of Agriculture, ICAR, New Delhi
- Krishnasamy et al., 2004. Compendium on Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore
- Srivastava K. P., 2009., A Text Book of Applied Entomology, Kalyani Publishers, Ludhiana
- Dahiya B. S. and Rai K. N. 1997. Seed Technology, Kalyani Publishers, Ludhiana
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- ISTA 1999 . Seed Science and Technology, Vol. 27, Supplement, Rules, International Seed Testing Association , Zurich , Switzerland .
- Khare D and M. S. Bhale 2000. Seed Technology Scientific Publishers (INDIA), Jodhpur.
- McDonald , M.B. and L.O. Copland . 1999. Seed Science and Technology Laboratory Manual. Scientific Publishers, Jodhpur ,
- K.Vanangamudi , N. Natarajan , A, Bhatathi , R. Umarani and T. Saravanan . Advances in Seed Science and Technology , Vol I .

TYBSc Vocational Seed Technology
Semester V
Paper-II (ST 3.2): Entrepreneurship Development (Credit-02. 30 lectures)

1 INTRODUCTION : 03

a) Concept of entrepreneurship
b) need and scope of entrepreneurship
c) Entrepreneurial behavior attributes and skills
d) Key elements of entrepreneur,
e) Entrepreneurial process, Entrepreneurial culture,

2 BUSINESS ORGANIZATIONS: 03

a) Forms of business organizations such as sole proprietorship, partnership, Joint Stock Company, cooperative organization etc.
b) Meaning and definition , Relative merits and demerits of each form, Types of Small Scale Industry.

3 Study of organizations promoting Entrepreneurship : 04

Sources of Information: Where to go for what?

a) District Industry Centre (DIC)
b) Maharashtra Industrial Development Corporation (MIDC)
c) Maharashtra State Small Industries Development Corporation (MSSI DC)
d) Small Industries Services Institute (SISI)
e) National Institutes of Entrepreneurship and Small business Development (NIESBUD)
f) National Entrepreneurship Development Board (12) (NEDB)
g) Entrepreneurship Development Institute of India
h) Commercial and Co-operative Banks
i) State Industrial Development Bank (SIDBI)
j) Pollution Control Board

4 Legal Aspects of Small Business: 03

a) Elementary knowledge of Income Tax,
b) Sales Tax,
c) VAT,
d) Service Tax,
e) Patent Rules,
f) Excise Rules,

Factory Act and Payment of Wages Act, TDS act Procedures for registration of SSI, TDS no, PAN no.

5 ENTREPRENEURSHIP DEVELOPMENT: 02

a) Identification of opportunities for entrepreneurship, ideas to start new business, criteria for selection of new product or service, Market Survey as a tool, Technical and economic feasibility of a project,
b) Role of consultancy organizations.

6 FINANCIAL ASPECTS:

Govt/Public sources of finance 03

a) Sources of finance,
b) Role of various funding agencies, government and commercial
c) Role of various funding corporations and funding institutes such as chamber of commerce, MSFC, MCED, NSSIDC, Banks, special institutes such as IDBI, MIDC,SICOM etc,

7 Private Sources: 03

a) Equity -Angel finance , Venture capital
b) Debt Finance - Loans from banks loan against co-lateral security, PMYR-Loans with subsidy from Central GOVT, State Govt , CGTSME(Central Grant For Small Medium Enterprise)

8 MARKETING ASPECTS: 03

a) Meaning, scope and importance,
b) Marketing strategy, Market segmentation, marketing channels.
c) Marketing mix and its effect.
d) Digital marketing through Web browsing, Face book , Google search engines SMS campaigns Mailers, Hand bills etc

9 HUMAN RESOURCE ASPECTS: (H.R Policies): 04

a) Concept and scope in modern industry,
b) Different modes of employment,
c) Placement of proper person for a job,
d) Interpersonal relations and communication skills, training of personnel, guidance for stress management, soft skills.
e) Drafting -Appointment letter, termination tenure , experience certificates , exit policies.
f) Legal liabilities of employees, Group insurance for factory workers, understanding WAC (Workers Accident Compensation)

Reference books (Latest Editions)

1. Environment & Entrepreneur: Mr.B.C.Tondon
2. Business Environment: Dr.G.V.Kayande Patil
3. Udyogvardhini –MCED
4. Basic Communication Skills: By P. Kiranmai Dutt & Geetha Rajeevan, 2000
5. Fundamentals of Office Management: By J.P. Mahajan , Office Management – By S. P.

Arrora, latest edition

6. A guide to small Scale Entrepreneurs, Director of Industries, Govt. of Tamil Nadu

Chennai,latest edition

7. Entrepreneurship and small Business Management- Dr. C. B. Gupta & Dr. Khanna
8. Project Management- K. Nagarajan
9. 100 project Reports Yashwantrao Chavan Open Universiy (YCMOU) Edition
10. Entrepreneurship Ideas in Action Cynthia L. Greene (YCMOU) Edition

TYBSc Vocational Seed Technology
Semester V

Practical Paper (ST 3.3): Practicals based on ST 3.1 (Seed Pathology and Entomology) and ST 3.2 (Entrepreneurship Development) (Credit: 02)

Practicals on ST 3.1 (Seed Pathology and Entomology) Credit: 01

1	Demonstration and handling of stereo binocular and research microscope	1P
2	Visual examination of dry seeds for disease symptoms	1P
3	Examination of suspensions obtained from washing of seeds	1P
4	Detection of important seed borne fungi with the help of Agar and blotter paper method	2P
5	Study of any one important pest of each crop with respect to their life cycle, way of infestation/damage, symptoms and control measures • Fibre crop – Boll worm/ Mites • Pulses – Pod borer • Cereals – Aphid/Army worm • Vegetables – Thrips/White fly • Storage pest- Rice weevil	2P
6	Visits to warehouse & godowns	1P

Practical's ST 3.2 (Entrepreneurship Development)) Credit:01

The practicals to be conducted are with an objective to transform the knowledge gained by the students in their classes to real life experience. These practical's will be based on the vocational subject and the Principal subject a student has offered

Sr. No	Title of Practical	Objective	Mode
1.	Role of District industry center	Understand the working of District industry center :01	Visit and report submission
2.	Visit to a small scale Industry	To understand plant location and plant layout and to submit a report on the guidelines given in schedule I 01	Visit and report submission
3.	Visit to a service unit	To study the legal aspects of a service unit and to submit a report 01	Visit and report submission

4.	Entrepreneurial ideas	Describe in brief two entrepreneurial ideas of yours 02	Preparation of Ideas
5.	Project formulation	Prepare a preliminary document about an enterprise you want to start It should contain executive summary, customer/target market analysis and strategy (use guidelines given in schedule II) 01	Preparation of schedules
6.	Review business plans For this Plans should be exchanged with other teams	Submit a review of a business plan of other team. It should include critical and constructive comments 01	Review submission
7.	Drafting a business	It should contain executive summary 01	Power Point

TYBSc Vocational Seed Technology
Semester VI
Paper-III (ST 3. 4): Seed Farm Management, Processing and Storage
Theory credits: 02 (30 lectures)

Chapter-1: Introduction **03**

1) Scope and objectives

Chapter-2: Farm Management **04**

1) Introduction and Definition

2) Objectives and scope of Farm management

3) Farm management vs Agricultural economics

4) Use of farm management in actual farming

Chapter-3: Farm Business **03**

1) Introduction

2) Factors involved in the selection of a business (Locality limitations, Capital limitations, Income limitations and personal inclination)

3) Comparison of general and specialized farming

Chapter-4: Management of Seed Processing **03**

1) Layout of seed processing plant

2) Basic flow pattern in seed processing plant

3) Types of layouts, Maintenance and management of the plant

Chapter-5: Seed Processing **05**

1) Various steps in seed processing

2) Receiving the seed in seed processing unit

3) Conditioning, Seed drying, Seed cleaning

6) Separation and grading

Chapter-6: Seed Treatment **03**

1) Need of seed treatment

2) Kinds and methods of seed treatment

a. Mechanical b. Physical c. Chemical

3) Seed treating equipments

Chapter-7: Seed Storage **06**

1) Bagging and its methods

2) Methods of seed storage

3) Storage containers

4) Factors affecting storability of seeds

5) Changes during seed storage

6) Basic requirements of seed storage

Chapter-8: Seed Marketing **03**

1) Introduction, Major components of seed marketing

3) Role of different seed organizations in seed marketing

References:

- Ponnuswamy , A.S. 2001 , Quality Seed Production in Hybrids Rice In Recent Techniques and Participatory Approaches on Quality Seed Production ICAR Winter School Training Manual , Dept . of Seed Science andTechnology , Tamil Nadu Agricultural University , Coimbatore 641 003, India .
- R. Umarani , R.Jerlin , N. Natrajan , P.Masilamani and A.S. Ponnuswamy , Experimental
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TYBSc Vocational Seed Technology
Semester VI
Paper-IV (ST 3. 5): Biotechnology and Intellectual Property Rights
(Credit-02. 30 lectures)

CREDIT-I:

Chapter-1: Introduction to Biotechnology **2L**

- Definition
- Branches of Biotechnology
- Scope of Biotechnology
- Techniques in biotechnology
    - Recombinant DNA Technology (Genetic Engineering)
    - Plant Tissue Culture
    - Transgenic (Genetically Modified Organisms)
- Application of Biotechnology

Chapter-2: Aids for variety identification **4L**

- PCR
- SDS-PAGE
- RFLP
- RAPDs
- DNA finger printing
- ELISA
- Southern Blotting
- Northern Blotting
- Western Blotting

Chapter-3: Methods of gene cloning **5L**

- *In vivo* gene cloning
- *In vitro* gene cloning
- Vectors used in gene cloning
    - Plasmid
    - Bacteriophage
    - Cosmid
    - Expression vectors
    - Transcription vectors
- Enzymes used in recombinant DNA technology
- Methodology for rDNA Technology
    - Isolation of DNA (Genes) from donor organism
    - Insertion of desired foreign gene into a cloning vector (Vehicle DNA)
    - Transfer of rDNA into suitable component host or cloning organism
    - Selection of the transformed host cell
    - Multiplication of transformed host cell
    - Expression of the gene to obtain the desired product

Chapter-4: Plant Tissue Culture **4L**

- Definition
- Tissue culture in Banana
- Anther culture
- Embryo culture
- Synthetic seeds
- Application of plant tissue culture

CREDIT-II:

Chapter-5: Transgenics/Genetically Modified Organisms **5L**

- Definition
- Important examples of GMO's
- Technique used in development of GMO
    - Isolation of the gene(s) of interest
    - Insertion of the gene(s) into a transfer vector and plant transformation
    - Selection and regeneration of the modified plant cells into whole plants
    - Verification of transformation and characterization of the inserted DNA fragment
    - Testing of plant performance
    - Safety assessment
- Application of Transgenics

Chapter-6: Intellectual Property Rights (IPR) **5L**

- Introduction
- History
- Need of IPR
- Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties (Plant Breeder's Rights) and Layout Design, Genetic Resources and Traditional Knowledge

Chapter-7: Patent Filling **2L**

- Rights of patentee
- Procedure for obtaining patents
- Infringement

Chapter-8: Plant Variety Protection **2L**

- Meaning
- Benefit sharing and farmers' rights
- Procedure for registration

Chapter-9: World trade organization **1L**

References:

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- Davies K (Ed) (2004) - Plant pigments and their manipulation - Annual plant revies, vol 14 (Blackwell Publ)
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- Vasil IK, Thorpe TA (1994) - Plant cell and tissue culture (Springer)
- H K Das Textbook of Biotechnology 4th edition

TYBSc Vocational Seed Technology
Semester VI
Practical Paper (ST 3.6): Practical's based on ST 3.4 (Seed Farm Management, Processing and Storage) and ST 3.5 (Biotechnology and Intellectual Property Rights) (Credit-02.)

Practical's based on theory paper- Seed Farm Management, Processing and Storage
(Practical's any 08) (Credit-01)

1) Study of seed treatment equipment's and application of various chemicals. **(2P)**

2) Visit to a seed processing and storage complex. **(2P)**

3) Study of air screen cleaner cum grader. **(1P)**

4) Study of different types of elevator and conveyors. **(1P)**

5) Study of seed packaging equipment's. **(1P)**

6) Study of specific gravity separator. **(1P)**

7) Soil sampling for fertility and moisture content. **(1P)**

8) Demonstration of some important farm machines. **(1P)**

9) One day visit with seed marketing executive. (**2P)**

Practical's based on paper-3.5 (Biotechnology and Intellectual Property Rights
Practical's any 08 (Credit-02.)

1	Peroxidase isozyme profiling for varietal identification	1P
2	Separation and detection of specific proteins using Western blotting	1P
3	Demonstration of PCR facility and DNA fingerprints (Photographs)	1P
4	Preparation of culture media, Sterilization of media and glassware	2P
5	Micropropagation of Banana	2P
6	Collection and filling of application forms for patent filing.	1P