

**Rayat Shikshan Sanstha's  
Yashwantrao Chavan Institute of Science,  
Satara  
(Autonomous)**

**Syllabus under Autonomy  
For  
B. Sc. II (Seed Technology)**

**Academic Year 2019 – 2020**

**Yashavantrao Chavan Institute of Science, Satara (Autonomous)**

**Syllabus for Bachelor of Science (B. Sc.) Part – II**

1. TITLE: **Seed Technology**
2. YEAR OF IMPLEMENTATION: **2019 – 2020**
3. DURATION: **01 year**
4. PATTERN: **CBCS Semester**
5. MEDIUM OF INSTRUCTION: **English**
6. STRUCTURE OF COURSE:

**1) FIRST SEMESTER (NO. OF PAPERS – 02)**

Sr. No.	Subject Title	Theory					Practical	
		Paper No. & Paper Code	Title of Paper	No. of lectures per week	Credits		No. of lectures Per week	Credits
1.	Seed Technology	Paper V: BBST 301	Hybrid Seed Production: Principle and Practice	6	4	Practical Paper I BBSP 303	8	4
		Paper VI: BBST 302	Recent Trends in Seed Technology					

**2) SECOND SEMESTER (NO. OF PAPERS – 02)**

Sr. No.	Subject Title	Theory					Practical	
		Paper No. & Paper Code	Title of Paper	No. of lectures per week	Credits		No. of lectures Per week	Credits
1.	Seed Technology	Paper-III: BBST 401	Seed Pathology and Seed Entomology	6	4	Practical Paper –II : BBSP 403	8	4

		Paper – IV: BBST 402	Recent Trends in Plant Breeding					
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### 3) Structure and titles of papers of B. Sc. Course

#### **B. Sc. II Semester III**

Paper V: Hybrid Seed Production: Principle and Practice

Paper VI: Recent Trends in Seed Technology

Botany Practical I: Practical's based on Theory paper V and VI

#### **B. Sc. II Semester IV**

Paper VII: Seed Pathology and Seed Entomology

Paper VIII: Recent Trends in Plant Breeding

Botany Practical II: Practical's based on Theory paper VII and VIII

### 4) OTHER FEATURES:

#### A) LIBRARY:

Reference books, Textbooks, Journal, Periodicals available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

#### B) SPECIFIC EQUIPMENTS:

a) Computer, LCD projector, visualizer, smart board

b) Laboratory Equipment's:

1. Microscope with digital camera
2. Stereo microscope
3. Digital weighing balance
4. Microtome
5. Autoclave
6. Hot Air Oven
7. Incubator
8. Refrigerator
9. Seed separator
10. Seed Triers

7. Evaluation Structure for B. Sc. II

Semester III

	ESE	Internal Exam		Practical			Submission	Total
		ISE-I	ISE-II		Exam	Journal	Seminar + Student Performance	
Paper V	30	5	5	Practical-III(A)	25	5	5	150
Paper VI	30	5	5	Practical IV(A)	25	5	5	

Semester IV

	ESE	Internal Exam		Practical			Submission	Total
		ISE-I	ISE-II		Exam	Journal	Industrial visit/Educational Tour + Student Performance	
Paper V	30	5	5	Practical-III(A)	25	5	5	150
Paper VI	30	5	5	Practical IV(A)	25	5	5	

**Yashavantrao Chavan Institute of Science, Satara (Autonomous)**

**Syllabus introduced from June 2019**

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**Bachelor of Science (B. Sc.) Part – II: Seed Technology**

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**Semester III**

**Theory Paper V: BBST 301- Hybrid Seed Production: Principle and Practice**

**Learning Objectives:**

1. To impart the basic knowledge of different aspects of hybrid seed production.
2. To impart the basic knowledge of hybrid seed production in cereal and pulse crops.
3. To impart the basic knowledge of hybrid seed production in oil seed and cash crops.
4. To impart the basic knowledge of hybrid seed production in vegetables.

**Total Lectures 45**

**Unit I Principles and methods of hybrid seed production (12)**

Selection of variety and its types; Selection of land for hybrid seed production; Agronomic management for hybrid seed production (sowing, row spacing, fertilizers, irrigation, harvesting and threshing); Previous crop effects; Effect of environment on seed quality

**Unit II Hybrid seed production in cereals and pulse crops (11)**

Floral biology, pollinators, agronomic practices, field inspection and maintenance of varietal purity of following crops:

- 1) Cereal crops: Rice, Jowar, Wheat
- 2) Pulse crops: Pigeon pea, chick pea, soybean

**Unit III Hybrid seed production in oil seed and cash crops (11)**

Floral biology, pollinators, agronomic practices, field inspection and maintenance of varietal purity of following crops:

- 1) Oil seed crops: Groundnut, sunflower
- 2) Cash crops: Sugarcane, pomegranate, banana

**Unit IV Hybrid seed production in vegetable crops (11)**

Floral biology, wild pollinators, agronomic practices, field inspection and maintenance of varietal purity of following crops: Onion, tomato, spinach

## Learning Outcomes

1. Student should learn about concepts in hybrid seed production.
2. Student should learn about hybrid seed production in different crop plants.
3. Student should get knowledge about principles and methods in hybrid seed production.
4. Student should learn different agronomic practices.

## References

1. A Text book of Botany Angiosperms- Singh, Pande, Jain-Rastogi publication New Delhi. (Unit II)
2. An Introduction to Embryology of Angiosperms- Maheshwari P. Mc Graw hill book co. New York. (Unit II, III)
3. An Introduction to Embryology- Vol. I Parihar N.S. (Unit II)
4. Angiosperm, Embryology and Taxonomy -Johri B.M. Bull. Nat. Institute. Science, India 34:263-268. (Unit IV)
5. Embryology of Angiosperms- Bhojwani and Bhatnagar. (Unit III)
6. Hand book of Agriculture ICAR, New Delhi. (Unit I)
7. Physiology and Biochemistry of Seed Dormancy and germination- North Holland, Amsterdam. (Unit IV)
8. Plant breeding Principles and Methodology –Sing B. D., Kalyani Publishers New Delhi. (Unit I)
9. Seed pathology, D.K. Jha, Vikas Publishing House pvt. Ltd. (Unit I)
10. Seed Production and field crops. Mondal, Saha, New India Publishers Agency, New Delhi. (Unit I)
11. Seed Science and Technology- Joshi and Singh. Kalyani Publishers New Delhi. (Unit IV)
12. Seed Technology- Agarwal R.N. Oxford and IBHJ Publication New Delhi. (Unit I)
13. Taxonomy of Angiosperms- Naik V.N., Tata McGraw Hill, New Delhi. (Unit III)

## **Theory Paper VI: BBST 302- Recent Trends in Seed Technology**

### **Learning Objectives:**

1. To impart the basic knowledge of recent trends in seed technology.
2. To impart the knowledge of methods of seed testing and seed certification.
3. To impart the knowledge of techniques practices in seed purity analysis.
4. To impart the knowledge of establishment of seed testing labs and role of seed organizations.

**Total Lectures 45**

### **Unit I: Seed Testing**

**(12)**

History, Objectives, importance, and Seed testing status in India; Germination testing: Concept, objectives, requirement, procedure and methods of seedling evaluation; Seed viability: Principle, objectives and methods of TZ test, embryo excision test; Seed moisture: Concept, objectives and methods for determination of seed moisture; Seed Vigor testing: Concept, objectives and methods for determination of seed vigor.

### **Unit II: Seed purity analysis**

**(11)**

Seed sampling and Dividing: Concept, objectives, Equipment's used e.g. Seed triers, seed dividers: procedure, handling and testing of samples; Physical purity analysis: Concept, objectives, equipment's used in physical purity analysis, procedure, and purity components; Heterogeneity test: Concept, objectives, symbols used, method for test and calculations.

### **Unit III: Seed certification**

**(11)**

Objectives and concept of seed certification; Classes of Seeds- Nucleus, Breeders, Foundation and Certified seeds; Seed certification standards and field inspection. Procedure of seed certification.

### **Unit IV: Seed testing laboratory and organizations**

**(11)**

Layout and infrastructure, staffing and equipments; National seed organizations- Central Seed Committee (CSC), Central Seed Testing Laboratory (CSTL), State Seed Certification Agencies (SSCA); International seed organizations- International seed Testing Authority (AOSA), OECD, and UPOV; Seed producing companies in India (Any 3)

## **Learning Outcomes**

1. Student should learn recent trends in seed technology.
2. Student should learn various aspects of seed testing.
3. Student should learn about establishment of seed testing laboratories
4. Student should learn functioning of seed organizations in India and abroad.

## **References**

1. Agarwal RN, Seed Technology. Oxford and IBHJ Publication New Delhi. (Unit I, II, III, and IV)
2. Copuland and Mc Donald B, Principles of Seed Science and Technology. Publishing co. USA. (Unit I, II, III, and IV)
3. Joshi, Singh, Seed Science and Technology. Kalyani Publishers New Delhi. (Unit I, II, III, and IV)



## **Practical Paper III: BBSP- 303 Practicals based on paper V and VI**

### **Learning objectives**

1. To give practical knowledge to students about hybrid seed production in different crop plants.
2. To give the practical knowledge about various methods of seed testing and certification.
3. To participate students in experiential learning with these practicals.

### **Practicals**

#### **Group A based on Paper V**

- 1-4. Study of inflorescence and floral morphology of Jowar, Rice, Pigeon pea, Soybean, Groundnut, Banana, Tomato, Sunflower.
5. Study of anther dehiscence and mounting of pollen of maize, sweet pea, *Phaseolus*, Brinjal and Banana.
6. Pollen viability test by acetocarmine and potassium iodide staining method.
- 7-8. Exercise in field area measurement and field map preparation.
9. Study of seed germination with different media. (paper, sand, saw dust and soil method)
10. Study of seed germination with hormonal treatment.

#### **Group B based on Paper VI**

11. To study seed vigor by physical method.
- 12-13. Study of seed moisture by oven dry and desiccators method.
14. Study of seed triers.
15. Draw working sample from bulk and conduct physical purity test of the same.
16. To study procedure of seed sample registration in STL.
17. Filling of application form for seed certification.
- 18-19. Survey, Collection and submission of different crops seeds available in local market.
20. Visit to seed testing laboratory/ seed treatment unit/ seed production farm.

### **Learning outcomes**

The students shall learn:

1. Reproductive biology of crop plants.

2. Identification of different varieties of crops.
3. Field area measurement and field map preparation.
4. Seed sample registration in seed testing laboratory and form filling.
5. Physical and biochemical methods in seed testing.
6. Understand the functioning of seed testing laboratory to understand its functioning.

### **References**

1. Agarwal RN, Seed Technology. Oxford and IBHJ Publication New Delhi.
2. Joshi, Singh, Seed Science and Technology. Kalyani Publishers New Delhi.
3. ISTA manual (Online)

## Semester IV

### Theory Paper VII: BBST-401 Seed Pathology and Seed Entomology

#### Learning Objectives:

1. To impart the basic knowledge of recent trends in seed pathology.
2. To impart the basic knowledge of mechanism of seed infection and its management.
3. To impart the basic knowledge of damage caused by stored grain pests.
4. To impart basic knowledge in management of damage caused by pathogens and insects.

**Total Lectures 45**

#### **Unit I: Introduction of Seed Pathology (12)**

Introduction, History and Importance of Seed Pathology; Seed borne diseases (fungi, bacteria, viruses, nematodes and phanerogams); Losses caused by seed pathogens

#### **Unit II: Seed Infection and Management (11)**

Concept and Significance of Infection; Mechanism of Transmission of seed pathogens; Preventive measures for seed borne pathogens practiced in India

#### **Unit III: Introduction to Seed Entomology (11)**

History and Importance; General model of life cycle of Insect (Gradual, Complete and Incomplete Metamorphosis); Losses caused by insects

#### **Unit IV: Seed Insect Pests and Their Management (11)**

Study of following insect pests with respect to scientific name, marks of identification, nature of damage and their management: Indian meal moth; Brinjal Fruit Borer Gram pod borer; Lesser Grain borer;; Rice Weevil; Rust red flor beetle; Khapra beetle; Pulse beetle;Saw toothed beetle.

#### Learning Outcomes

1. Student should learn pathogens affecting seed quality.
2. Student should learn pests affecting the quality and storage life of seeds.
3. Student should learn about different techniques of identification of pathogen and pests.
4. Student should learn the management of pathogens and pests.

#### References:

1. Agarwal VE, Sincelair JB, Principles of seed pathology Vol. I & II. (Unit I, II)

2. Alexopoulos CJ, Introductory mycology. McMillan Publishers Ltd. (Unit I, II)
3. Atwal AS, Agricultural Entomology. New Age Publication Co., New Delhi. (Unit I, II, III, IV)
4. Bindra DS, Plant Protection and equipments. (Unit I, II)
5. Gregg BR, Law AG, Virde SS, Balis JS, Seed Processing. (Unit I, II)
6. Kahlona A. S. and Karam Singh – Economics of farm management in India. (Unit IV)
7. Mary Noble & M.J. Richardson – An annotated list of seed borne diseases. (Unit IV)
8. Metcalf & Flint –Destructive & Useful Insects. (Unit III, IV)
9. Michael D. Boehlje & Verman R. Eidman –Farm management. (Unit IV)
10. Neergaard – Seed Pathology vol. I & II. (Unit IV)
11. Nene YL, Thapliyal MJ, Fungicides in plant disease control. (Unit II)
12. Raju VT, Rao DV, Economics of Farm production & management. (Unit II)
13. Vyas SC, Systematic Fungicides. (Unit II)

## **Theory Paper VIII: BBST- 402 Recent Trends in Seed Production**

### **Learning Objectives:**

1. To impart the basic knowledge of different aspects of plant breeding.
2. To impart the basic knowledge of heterosis and inbreeding depression.
3. To impart the basic knowledge of male sterility and self-incompatibility in crops.
4. To impart the knowledge of recent advances in plant breeding in relation to seed production.

**Total Lectures 45**

### **Unit I Heterosis and inbreeding depression**

**(12)**

Introduction of heterosis; Genetic basis of heterosis; Type of heterosis; Commercial exploitation of heterosis; Introduction of inbreeding depression; Genetic basis of inbreeding depression; Commercial utilization

### **Unit II Male sterility**

**(11)**

Definition and types of male sterility; GMS – Introduction and its uses; CMS – Introduction and its uses; C-GMS – Introduction, seed production of A, B and R-lines; Environmental sterility; Induction and application of male sterility

### **Unit III Self incompatibility**

**(11)**

Definition, genetic basis of self-incompatibility, types of incompatibility, merits and demerits; Methods of breaking incompatibility (pollen irradiation, application of NAA and IAA); Differences between sterility and self-incompatibility

### **Unit IV Biotechnological applications**

**(11)**

Haploid production; Somaclonal variation; Embryo rescue; Synthetic seed production and cybrids; GM crops (Bt cotton)

### **Learning Outcomes**

1. Student should learn concept of heterosis, inbreeding depression and its applications in crop improvement.
2. Student should learn concept of male sterility and its application.
3. Student should learn the concept of self incompatibility and its application.
4. Student should learn the latest techniques used in crop improvement.

**References:**

1. Chawla HS: Plant Biotechnology: Theory and Practice. (Unit IV)
2. Chopra L (2001) Plant Breeding of Field Crops. Oxford IBH Pvt. Ltd. New Dehli. (Unit I, II, III, and IV)
3. Singh BD: Plant Biotechnology. (Unit IV)
4. Singh Prem and Arya – Vegetable breeding and seed production. Kalyani Publ. Ludhiana. (Unit I, II, III, and IV)
5. Singh, BD (2006) Plant Breeding 2<sup>nd</sup> Ed. Kalyani Publ. Ludhiana. (Unit I, II, III, and IV)

## **Practical Paper III: BBST- 403 Practicals based on Paper VII and VIII**

### **Learning objectives**

1. To give practical knowledge to students about seed pathology and entomology.
2. To give the practical knowledge about various methods involved in crop improvement.
3. To participate students in experiential learning with these practical's.

### **Practicals**

#### **Group A based on Paper VII**

- 1-2. Study of seed borne pathogens (Any five seeds).
3. Microscopic examination of dry seeds for disease symptoms. (Any five seeds).
4. Detection of important seed borne fungi by Blotter method.
5. External morphology of insect, types of mouth parts, antenna and legs.
6. Study of important stored grain pests (Any five pests).
7. Study of life cycle of suitable stored grain pests (any two).
8. Seed treatment equipments and their safe handling for seed technology.
9. Study of pesticides formulation, preparation for seed treatment.
10. Collection and submission of stored grain pest.

#### **Group B based on Paper VIII**

11. Study of breeder's kit.
12. Emasculation of various crops. (Maize, Cotton, Wheat).
13. Studies of protogynous and protandrous flowers in Jowar and sunflower.
- 14-16. Preparation of culture medium (MS) and culture of embryo.
- 17-18. Use of chemical gametocides during flowering and study of its effect.
19. Demonstration of GM crops using suitable example (BT Cotton).
20. Visit to tissue culture laboratory and submission of its report.

### **Learning outcomes**

Students should learn:

1. Principles in seed pathology.
2. Principles in seed entomology.
3. Methods of management of pathogens and pests.

4. Methods in plant breeding.
5. Pollen physiology.
6. Fundamentals of GMO's.

**References:**

1. Chawla HS: Plant Biotechnology: Theory and Practice.
2. Singh, B. D. - Plant Breeding 2 ed. 2006. Kalyani publ. Ludhiana.
3. Atwal AS, Agricultural Entomology. New Age Publication Co., New Delhi
4. Neergaard – Seed Pathology vol. I & II.