Rayat Shikshan Sanstha's
YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA

(AN AUTONOMOUS COLLEGE)

Reaccredited by NAAC with 'A+' Grade

Bachelor ofScience

Part - II

Seed Technology

Syllabus

to be implemented w .e. f. June, 2022-23

Sr. No.	Subject title	Theory					Practical	
		Course No. and Course code	Title of Course	No. of lectures per week	Credits		No. of lectures per week	Credits
1.	Seed Technology	Course V BBST 301	Hybrid Seed Production: Principle and Practice	6	4	Practical Paper BBSP 303	4	2
		Course VI BBST 302	Recent Trends in Seed Technology		4			

B. Sc. II: Seed Technology

1) Semester III

2) Semester IV

Sr. No	Subject title	Theory					Practical	
		Course No.and Course Code	Title of Course	No. of lectures per week	Credits		No. of lectures per week	Credits
1.	Seed Technology	Course VII BBST 401	Seed Pathology and Seed Entomology	6	4	Practical Paper BBSP 403	4	2
		Course VIII BBST 402	Recent Trends in Plant Breeding		4			

B.Sc. II: Seed Technology

Semester III

Code	Name of Course	Units
BBST 301	HYBRID SEED PRODUCTION: PRINCIPLE AND PRACTICE (CREDITS:04; TOTAL HOURS : 45)	Unit I: Principles and methods of hybrid seed production Unit II: Hybrid seed production in cereals and pulse crops Unit III : Hybrid seed production in oil seed and cash crops Unit IV : Hybrid seed production in vegetable crops
BBST 302	Recent Trends in Seed Technology (CREDITS:04; TOTAL HOURS : 45)	Unit I:Seed Testing Unit II: Seed purity analysis Unit III : Seed certification Unit IV : Seed testing laboratory and organizations

Semester IV

Code	Name of Course	Units
BBST 401	SEED PATHOLOGY AND SEED ENTOMOLOGY (CREDITS:04; TOTAL HOURS : 45)	Unit I: Introduction of Seed Pathology Unit II: Seed Infection and Management Unit III : Introduction to Seed Entomology Unit IV : SeedInsect Pests and Their Management
BBST 402	RECENT TRENDS IN SEED PRODUCTION (CREDITS:04; TOTAL HOURS : 45)	Unit I:Heterosis and inbreeding depression Unit II: Male sterility Unit III : Self incompatibility Unit IV : Biotechnological applications

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Bachelor of Science (B. Sc.) Part – II

Semester – III

Course BBST301: HYBRID SEED PRODUCTION: PRINCIPLE AND PRACTICE

Course Objectives: Student will be able to

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

Total Credits 4	SEMESTER-III BBST 301 HYBRID SEED PRODUCTION: PRINCIPLE AND PRACTICE	No. of hours per unit/credits
Credit 1 **UNIT - I**	**Principles and methods of hybrid seed production**	**(12)**
	1.1 Selection of variety and its types, Selection of land for hybrid seed production 1.2 Agronomic management for hybrid seed production (sowing, row spacing, fertilizers, irrigation, harvesting and threshing), Previous crop effects 1.3 Effect of environment on seed quality	
UNIT – II **Credit 1**	**Hybrid seed production in cereals and pulse crops**	**(11)**

	2.1 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, Vigna	
UNIT - III **Credit 1**	**Hybrid seed production in oil seed and cash crops**	**(11)**
	3.1 Floral biology, pollinators, agronomic practices, field inspection and maintenance of varietal purity of following crops: 1) Oil seed crops: Groundnut, Sunflower, Soybean 2) Cash crops: Sugarcane, pomegranate, banana	
UNIT - IV **Credit 1**	**Hybrid seed production in vegetable crops**	**(11)**
	4.1 Floral biology, wild pollinators, agronomic practices, field inspection and maintenance of varietal purity of following crops: Onion, tomato, spinach 4.2 Advances in hybrid seed production	

Course outcomes:

Student should be able to

1. Understandconcepts in hybrid seed production.
2. Learn about hybrid seed production in different crop plants.
3. Understand the principles and methods in hybrid seed production.
4. Learn different agronomic practices.

References-

1. Agarwal R.L. *Seed Technology*. 2nded. New Delhi: Oxford and IBH Publishing Company Pvt. 2003.

2. Chopra V.L. *Plant Breeding Field crops*. New Delhi: Oxford and IBH Publishing Company Pvt. Ltd. 2001.

3. Fagaria M.S., Choudhary B.R., Dhaka R.S. *Vegetable Crops Production Technology*. New Dehli: Kalyani Publisher. 2003.

4. Joshi A.K., Singh B.D. *Seed Science and Technology*. New Delhi: Kalyani Publishers. 2005.

5. Khan A.A. *Physiology and Biochemistry of Seed Dormancy and Germination*. Amsterdam: North Holland Publication Company. 1977.

6. Khare D., Bhale M.S. *Seed Technology*. 2nd ed. Jodhpur: Scientific Publisher. 2014.

7. Maheshwari P. *An Introduction to Embryology of Angiosperms*. New York: McGraw Hill Book Co. 1950.

8. Pandey B.P. *A Text book of Botany Angiosperms*. New Delhi: S. Chand and Company Ltd. 2001.

9. Prasad R. *Textbook of Field Crop Production*. New Delhi: Directorate of information and Publication of agriculture. 2004.

10. Ransingh S., Kolhapure A. *Principals of Seed Technology*. Pune: Universal Publication. 2013.

11. Singh B.D. *Plant Breeding*. 2 nd ed. Ludhiana: Kalyani Publication. 2006.

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Bachelor of Science (B. Sc.) Part – II

Semester III

Course –BBST- 302:Recent Trends in Seed Technology

Course Objectives:

Student will be able to

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

Total Credits - 4	**SEMESTER-III** **BBST 302** **Recent Trends in Seed Technology**	**No. of hours per unit/credits**
UNIT - I **Credit-1**	**Seed Testing**	**(12)**
	1.1 History, Objectives, importance, and Seed testing status in India 1.2 Germination testing: Concept, objectives, requirement, procedure and methods of seedling evaluation. 1.3 Seed viability: Principle, objectives and methods of TZ test, embryo excision test. 1.4 Seed moisture: Concept, objectives and methods for determination of seed moisture.	

	1.5 Seed Vigor testing: Concept, objectives and methods for determination of seed vigor.	
UNIT - II Credit-1	**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. 2.2 Physical purity analysis: Concept, objectives, equipment's used in physical purity analysis, procedure, and purity components. 2.3 Heterogeneity test: Concept, objectives, symbols used, method for test and calculations.	
UNIT - III Credit-1	**Seed certification**	**(11)**
	Objectives and concept of seed certification. 3.2 Classes of Seeds- Nucleus, Breeders, Foundation and Certified seeds. 3.3 Seed certification standards and field inspection. Procedure of seed certification.	
UNIT – IV Credit -1	**Seed testing laboratory and organizations**	**(11)**
	4.1 Layout and infrastructure, staffing and equipments. 4.2 National seed organizations- Central Seed Committee (CSC), Central Seed Testing Laboratory (CSTL), State Seed Certification Agencies (SSCA). 4.3 International seed organizations- International Seed Testing Authority (ISTA), Association of Official Seed Analysts (AOSA), Organization for Economic Co- operation and Development (OECD), International Union for the Protection of New Verities of plants (UPOV) 4.4 Seed producing companies in India (Any 3)	

Course outcomes-

Students should be able to

1. Understand recent trends in seed technology.
2. Learn various aspects of seed testing.
3. Imbibe about establishment of seed testing laboratories
4. Understand functioning of seed organizations in India and abroad.

References

1. Agarwal R.L. *Seed Technology*. 2nded. New Delhi: Oxford and IBH Publishing Company Pvt. 2003.
2. Chopra V.L. *Plant Breeding Field crops*. New Delhi: Oxford and IBH Publishing Company Pvt. Ltd. 2001.
3. Joshi A.K., Singh B.D. *Seed Science and Technology*. New Delhi: Kalyani Publishers. 2005.
4. Khan A.A. *Physiology and Biochemistry of Seed Dormancy and Germination*. Amsterdam: North Holland Publication Company. 1977.
5. Khare D., Bhale M.S. *Seed Technology*. 2nd ed. Jodhpur: Scientific Publisher. 2014.
6. Singh B.D. *Plant Breeding*. 2 nd ed. Ludhiana: Kalyani Publication. 2006.

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Bachelor of Science (B. Sc.) Part – II

Semester III

BBSP 303: Seed Technology Practical III

Course Objectives:

Students

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.

Total Credit - 04	**SEMESTER-III BBSP 303 Seed TechnologyPractical III**	**No. of hours per unit/credits**
Credit 2 Section -I	HYBRID SEED PRODUCTION: PRINCIPLE AND PRACTICE	**10**
	1. Studies of inflorescence, floral arrangement, floral morphology of Jowar or Rice or Pigeon pea or Soybean or Groundnut or Banana and Tomato. 2. Studies of inflorescence, floral arrangement, floral morphology of Sunflower. 3. Survey, Collection and submission of different crops seeds. 4. Exercise in field area measurement and field map	

	preparation. 5. & 6. To study procedure of seed sample registration in Seed Testing Laboratory (STL) and Filling of application form for seed certification.	
Credit 2 **Section -II**	**Recent Trends in Seed Technology**	**10**
	7. To study of seed germination percentage by Germination paper, sand and soil method. 8. & 9. To study seed viability test by TTC method and to study seed moisture by oven dry method. 10. To study seed vigor testing by physical method. 11. To draw the working sample and conduct the physical purity test. 12. Study of seed triers. 13.Compulsory visit to seed testing laboratory Study of seed triers.	

Course outcomes-

Students should be able to-

1.Understand reproductive biology of crop plants.

2. Imbibe knowledge of different tests related to seed.

3. Understand handling of different Instruments related to seed

4. Imbibe Seed sample registration and seed certification.

Practical references-

1. Agarwal R.L. *Seed Technology*. 2nded. New Delhi: Oxford and IBH Publishing Company Pvt. 2003.

2. Joshi A.K., Singh B.D. Seed Science and Technology. New Delhi: Kalyani Publishers. 2005.

3. Khare D., Bhale M.S. *Seed Technology*. 2nd ed. Jodhpur: Scientific Publisher. 2014.

4. Ransingh S., Kolhapure A. *Principals of Seed Technology*. Pune: Universal Publication. 2013.

5. Singh G. *Seed Industry in India*: *A Management Perspective*. New Delhi: Oxford and IBH Publishing Company Pvt. Ltd. 1990.

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Bachelor of Science (B. Sc.) Part – II

B. Sc. II Seed Technology

Semester IV

BBST 401:Seed Pathology and Seed Entomology

Learning objectives:

Students will be able to

1. Understand recent trends in seed pathology.
2. Imbibe of mechanism of seed infection and its management.
3. Understand damage caused by stored grain pests.
4. Understand management of damage caused by pathogens and insects.

Credits=4	**SEMESTER-IV** **BBST 401 Seed Pathology and Seed Entomology**	**No. of hours per unit/ credits**
Credit –I **Unit-I:**	**Introduction of Seed Pathology** 1.1 Seed infection: Concept and its significance in seed pathology. 1.2 Seed borne Diseases: Study of following diseases in crops with reference to host, causal organism, symptoms and management 1.3 Definition of seed borne and storage fungi	**(12)**

	Common seed borne fungi (Any two) with examples. 1.4 Common storage fungi (Any two) with examples	
Credit –1 **UNIT II**	**Seed Infection and Management**	**(11)**
	2.1 Differences between seed borne and storage fungi 2.2 Mechanism of seed transmission and entry point of seed infection. 2.3 Entry points of seed infection. 2.4 Influence of environmental factors on seed borne diseases.	
Credit –1 **UNIT III**	**Introduction to Seed Entomology**	**(11)**
	3.1 Definition of seed entomology, Qualitative and Quantitative losses caused by insect pests. 3.2 Beneficial and harmful insect pests with examples 3.3 Life cycle pattern of insects 3.4 Methods of insect pest control: cultural, mechanical, physical, cemical products	
Credit –1 **UNIT IV**	**SeedInsect Pests and Their Management**	**(11)**
	4.1 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 flour beetle; Khapra beetle; Pulse beetle; Saw toothed beetle.	

Course 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 V.E., Sincelair J. B. *Principles of seed pathology* Vol. I & II. 2nd Boca Raton: CRC Press. 1996.
2. Alexopoulus C.J. *Introductory Mycology*. McMillan Publishers Ltd. 2007.
3. Atwal A.S. *Agricultural Entomology*. New Age Publication Co., New Delhi.1976
4. Bindra D.S. *Plant Protection and equipments*.
5. Gregg B.R., Law A.G., Virde S.S., Balis J.S. *Seed Processing.*National seeds corpon. New Delhi, 1970.
6. Kahlona A.S., Karam Singh – *Economics of farm management in India*. Allied Publishers, New Delhi 1992.
7. Noble M., Richardson M.J. *An annotated list of see borne diseases*. 2nd ed. Kew, UK: International Seed Testing Association. 1968.
8. Metcalf & Flint –*Destructive & Useful Insects.* McGraw-Hill; New York, 1962
9. Boehlje M.D., Eidman V.R. *Farm management*. John Wiley and Sons, 1984
10. Neergaard P. – *Seed Pathology* vol. I & II. Macmillan International Higher Education, 2017.
11. Nene Y.L., Thapliyal M.J. *Fungicides in plant disease control.*Medtech, 2017.
12. Raju V.T., Rao D.V. *Economics of Farm production & management*. Oxford and IBH Publishing Co Pvt. Ltd., 2017
13. Vyas S.C. *Systematic Fungicides*. Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1984

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Bachelor of Science (B. Sc.) Part – II

Seed Technology

Semester IV

BBST 402: Recent Trends in Seed Production

Course objectives:

Students will be able to

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

Credits=4	**SEMESTER-IV** **BBST 402 : Recent Trends in Seed Production**	**No. of hours per unit/ credits**
Credit –1 **Unit-I:**	**Heterosis and inbreeding depression**	**(12)**
	1.1 Heterosis- Genetic basis and its types, Commercial exploitation of heterosis. 1.2 Introduction of inbreeding depression, Genetic basis of inbreeding depression, Commercial utilization	
Credit –1 **UNIT II**	**Male sterility**	**(11)**
	2.1 Definition and types of male sterility 2.2 GMS – Introduction and its uses 2.3 CMS – Introduction and its uses 2.4 C-GMS – Introduction, seed production of A, B and R-lines 2.5 Environmental sterility	

	2.6 Induction and application of male sterility	
Credit –1 **UNIT III**	**Self incompatibility**	**(11)**
	3.1Definition, genetic basis of self-incompatibility, types of incompatibility, merits and demerits 3.2Methods of breaking incompatibility (pollen irradiation, application of NAA and IAA) 3.3Differences between sterility and self-incompatibility	
Credit –1 **UNIT IV**	**Biotechnological applications**	**(11)**
	4.1 Haploid production 4.2 Somaclonal variation 4.3 Embryo rescue 4.4 Synthetic seed production and cybrids 4.5 GM crops (Bt cotton)	

Course 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 H.S. *Introduction to Plant Biotechnology*. 3rdEd Oxford and IBH Publication Co. Pvt. Ltd. New Delhi 2009.
2. Chopra L. *Plant Breeding of Field Crops*. Oxford IBH Pvt. Ltd. New Dehli. 2001
3. Singh B. D. *Plant Biotechnology*. 2001
4. Singh Prem and Arya*Vegetable breeding and seed production.*Kalyani Publ. Ludhiana 1999.
5. Singh B.D. *Plant Breeding* 2nd Ed. Kalyani Publ. Ludhiana. 2006.
6. Basavaragu G. V., Ravishankar P., Gowdiperu S. *A Test Book Of Seed Science And Technology*. Kalyani Publication New Delhi. 2014.

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Bachelor of Science (B. Sc.) Part – II

Semester IV

BBSP 403- Practical Course

Course objective:

Students will be able to

1. Get practical knowledge about seed pathology and entomology.
2. Get the practical knowledge about various methods involved in crop improvement.
3. Participate in experiential learning with these practicals.

Credit =4	**Semester IV** **BBSP 403 : Practical course**	**No. of hours per unit/credits**
Credit 2 **Section I**	**Seed Pathology and Seed Entomology**	**10**
	1. Study of seed borne pathogens (Any three). 2. Microscopic examination of dry seeds for disease symptoms. (Any three). 3. Detection of important seed borne fungi by Blotter method. 4. External morphology of insect,types of mouth parts, antenna and legs. 5. Identification of important stored grain pest (Any three). 6. To study equipments and their safe handling for seed technology (Hand rotary duster and Knapsack sprayer. 7. Study of pesticides formulation,	

	preparation for seed treatment. 8. Collection and submission of stored grain pest.	
Credit 2 **Section -II**	**Recent Trends in Seed Production**	**10**
	9. Study of breeder's kit. 10. Emasculation of various crops. (Maize, Cotton, Wheat). 11. .Studies of protogynous and protandrous flowers in Jowar and sunflower. 12. Study of pollen viability. 13. Study of pollen germination. 14. Preparation of Murashige and Skoogculture medium (MS). 15. Demonstration of GM crops using suitable example (BT Cotton).	

Course outcome:

Student should be able to

1. Perform basic techniques of identification of dry seed disease symptoms ,seed born pathogen and study of identification of insect, instect morphology, types of mouth parts, antenna and legs.
2. Perform techniques to identification of stored grain pest and its control measeures and safe handling of seed technology equipments.
3. Know pesticides formulation and preparation and how to collection of stored grain pest and its identification.
4. Know breeders kit equipments and emasculation practices in hybridization techniques.
5. Study of protandrous and protogynous flowers and techniques for pollen viability and seed germination test and calculatthepercentange.
6. Techniques for preparation of Murashinge and Skoog culture medium and demonstration of GM crops.

References:

1. Chawla H.S. *Introduction to Plant Biotechnology*. Theory and Practice 3rdEd Oxford and IBH Publication Co. Pvt. Ltd. New Delhi 2009.
2. Singh B.D. *Plant Breeding* 2nd Ed. Kalyani Publ. Ludhiana. 2006.
3. Atwal A.S. *Agricultural Entomology*. New Age Publication Co., New Delhi.1976
4. Neergaard P. – *Seed Pathology* vol. I & II. Macmillan International Higher Education, 2017.