

**Karmaveer Bhaurao Patil University, Satara
Yashavantrao Chavan Institute of Science, Satara
(Autonomous)**

**Syllabus under Autonomy
For
B. Sc. I (Seed Technology)
As Per NEP-2020**

Academic Year 2023 - 2024

Karmaveer Bhaurao Patil University, Satara
Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Syllabus for Bachelor of Science (B. Sc.) Part - I

1. TITLE: Seed Technology

2. YEAR OF IMPLEMENTATION: 2023 - 2024

3. PREAMBLE:

The B. Sc. Seed Technology Course-under autonomy will be effective from the academic year 2023 - 2024. It has been prepared to keep in view the unique requirements of B. Sc. Seed Technology students as per NEP-2020. The contents have been drawn up to accommodate the widening horizons of the discipline of biological sciences. The emphasis is to provide students with the latest information along with due weightage to the concepts of classical botany so that they can understand and appreciate the current interdisciplinary approaches in the study of plant sciences and their role in societal development. The Course-content also lists new practical exercises so the students get a hands-on experience with the latest techniques that are currently in use. The Course-will also inspire students to pursue higher studies in Seed Technology, for becoming an entrepreneur, and enable students to get employed in plant-based industries.

4. GENERAL OBJECTIVES OF THE COURSE:

- i. To introduce the concept of the new concepts in seed technology.
- ii. To enrich students training and knowledge that would be useful in seed industries so that the farmers will get quality seeds.
- iii. To develop skill in practical work, experiments and laboratory materials in seed technology.
- iv. To help students build up a progressive and successful career in seed industry.
- v. To inculcate the sense of job responsibilities and to promote the possibilities of self-employment.

5. DURATION: 01 year

6. PATTERN: CBCS Semester

7. MEDIUM OF INSTRUCTION: English

8. STRUCTURE OF COURSE:

Course-Structure as per NEP-2020

Level	Sem	Subject - 1 Major				Subject - 2 Minor		Subject - 3 GE / OE		VSEC		AEC, VEC, IKS			OJT, FP, CEP, CC, RP				Total	Non - CGPA
		DSC		DSE		T	P	T	P	VSC	SEC	AEC	IKS	VEC	CC	FP	CEP	OJT /Int/App/ RT		
		T	P	T	P															
4.5	I	4	2	---	---	4	2	4	2				2		2	---			22	
	II	4	2	---	---	4	2	4	2		2		---	2		---			22	DEGG
5	III	4	4	---	---	2	2			2	2	4	---	2					22	
	IV	4	4	---	---	2	2			2	2	4	---		2				22	
5.5	V	4	2	4	2	---	---	---		4			---		2	2	2		22	
	VI	4	2	4	2	---	---	---		2					2	2		4	22	IIC
6	VII	8	2	8		4	---	---		---		---	---			---			22	
	VIII	8	2	8		---	---	---		---		---	---			---		4	22	
Total		40	20	24	4	16	8	12		10	6	8	2	4	8	4	2	8	176	
		88				24		12		16		14			22					

1) FIRST SEMESTER

Sr. No.	Course Title	Theory					Practical	
		Course-No. & Course-Code	Title of Course	No. of lectures per week	Credits		No. of lectures Per week	Credits
1.	Seed Technology (Major)	Course- I(BST 111)	Seed Development and Morphology	4	4	Practical Course— I (BSP113)	4	2
		Course- II(BST 112)	Fundamentals of Seed Technology					
2.	Seed Technology (Minor)	Course- I(BST 114)	Crop Wild Relatives	4	4	Practical Course— I (BSP116)	4	2
		Course- II (BST 115)	Techniques of Seed processing and preservation					
3.	Generic Elective (For Seed Technology Major Students)	Course- I	Agricultural Economics	4	4	Practical Course-- I	4	2
		Course- II	Seed marketing and Management					
	Open Elective (For other faculty students)	Course- I(BST 117)	Seed Preservation	4	4	Practical Course— I (BSP119)	4	2
		Course- II(BST 118)	Seed Bank Formation					
4.	IKS	Course- I(IKS 101)	Indian Agriculture	3	2	--	--	--
5.	Cocurricular Course- (CC)	(CC 102)			2	--	--	--

2) SECOND SEMESTER

Sr. No.	Course Title	Theory					Practical	
		Course-No. & Course-Code	Title of Course	No. of lectures per week	Credits		No. of lectures Per week	Credits
1.	Seed Technology (Major)	Course-III (BST 121)	Instrumentation and Techniques in Seed Technology	5	4	Practical Course-- II (BSP123)	4	2
		Course-IV (BST 122)	Vegetable Seed Production					
2.	Seed Technology (Minor)	Course-III (BST 124)	Seed Quality control	5	4	Practical Course-- II (BSP 126)	4	2
		Course-IV (BST 125)	Seed Production in Field crops					
3.	Generic Elective (For Seed Technology Major Students)	Course--III	Seed legislation and certification	5	4	Practical Course-- II	4	2
		Course-IV	Agricultural research and rural development programs					
	Open Elective (For other faculty students)	Course-III	Seed Quality Testing (BST 127)	5	4	Practical Course-- II (BSP 129)	4	2
		Course-IV	Seed Certification and Marketing (BST 128)					
4.	SEC	Course--I (SEC 103)	Crop Improvement (Hybrid seed production)	3	2	--	--	--
5.	VEC (Value Education Courses)	(VEC 104)	Digital Technology VEC-104		2	--	--	--

2) Structure and titles of B. Sc. Course

B. Sc. I

Seed Technology Major

Course-I (BST 111): Seed Development and Morphology

Course-II (BST 112): Fundamentals of Seed Technology

Practical Course- I (BSP 113): Practicals based on Courses- I and II

Seed Technology Minor

Course-I (BST114): Crop Wild Relatives

Course-II (BST115): Techniques of Seed processing and preservation

Practical Course- I (BSP 116): Practicals based on Courses- I and II

Generic Elective

Course-I: Agricultural Economics

Course-II: Seed marketing and management

Practical Course--I: Practicals based on Courses I and II

Open Elective

Course-I (BST 117): Seed Preservation

Course-II (BST 118): Seed Bank formation

Practical Course-I (BSP 119): Practicals based on Courses- I and II

IKS (Indian Knowledge System)

Course-I (IKS 101): Indian Agriculture

CC (Curricular Course) (CC 102)

B. Sc. I

Seed Technology Major

Course-III (BST 121): Instrumentation and Techniques in Seed Technology

Course-IV (BST 122): Vegetable Seed Production

Practical Course- II (BSP 123): Practicals based on Courses -III and IV

Seed Technology Minor

Course-III (BST 124): Seed Quality Control Seed Quality control

Course-IV (BST 125): Seed Production in Field Crops Seed Quality control

Practical Course- II (BSP 126): Practicals based on Courses- III and IV

Generic Elective

Course-III: Seed legislation and certification

Course-IV: Agricultural research and rural development

Practical Course-II: Practicals based on Courses- III and IV

Open Elective

Course-III (BST 127): Seed Quality Testing

Course-IV (BST 128): Seed Certification and Marketing

Practical Course-II (BSP 129): Practicals based on Courses-III and IV

SEC (Skill Enhancement Course)

Course-I (SEC 103): Crop Improvement (Hybrid Seed Production)

VEC (Value Education Courses) (VEC 104) - Digital Technology

3) OTHER FEATURES:

A) LIBRARY:

Reference Books, Textbooks, journals, and Periodicals are available in Institute and Departmental Library. (Separate reference lists are attached along with the respective Course-syllabus)

B) EQUIPMENT:

a) Computer, LCD projector, visualizer, smart board

b) Laboratory Equipment:

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|-------------------------------------|-----------------------------|
| 1. Microscope with a digital camera | 2. Digital weighing balance |
| 3. pH meter | 4. Microtome |
| 5. Autoclave | 6. Hot Air Oven |
| 7. Incubator | 8. Refrigerator |

Karmaveer Bhaurao Patil University, Satara
Yashavantrao Chavan Institute of Science, Satara
Syllabus to be introduced from June 2023

Bachelor of Science (B. Sc.) Part - I

Seed Technology (Major)

Semester- I

Course-I (BST 111): Seed Development and Morphology

Course Objectives: The student should be able to----

1. understand the concept of seed technology.
2. identify seeds based on morphological characters.
3. impart Knowledge about reproduction in plants.
4. know about seed structure and development.

Credits (02)	Course-I (BST 111): Seed Development and Morphology	No. of hours per unit
Unit I	Introduction to Seed Technology	07
	1.1 Need and Role of Seed Technology. 1.2 Concept of Seed, Definition and types (based on endosperm, no. of cotyledons and viability), difference between Seed and Grain, importance of seed to plant and human. 1.3 Morphology of crop and seed for identification of varieties of following crops- Potato, Onion, Jowar, Wheat, Soybean & Sugarcane. (Any two locally cultivated varieties).	
Unit II	Crop Families and Embryology	08
	2.1 Classification of crops (based on season, lifecycle, uses), Major crops belonging to the Dicotyledons and Monocotyledons families –Fabaceae (<i>Phaseolus, Glycine</i>), Brassicaceae (<i>Brassica, Raphanus</i>), Solanaceae (Brinjal, Tomato), Poaceae (Jowar, Maize). 2.2 Structure of anther and ovule. 2.3 Fertilization, Endosperm formation & Embryo.	
Unit III	Reproductive Biology	08

	<p>3.1 Structure of Dicotyledonous and Monocotyledonous flowers- Unisexual (Cucurbits and Maize) and Bisexual (Beans and Jowar); Monoecious, Dioecious Plants.</p> <p>3.2 Pollination and Pollinating agents.</p> <p>3.4 Apomixis & Polyembryony.</p>	
Unit IV	Seed structure and Development	07
	<p>4.1 Structure of Dicotyledonous and Monocotyledon seeds, external and internal characters e.g. Cotton, Pea, Castor and Maize.</p> <p>4.2 Seed ripening and maturation process.</p> <p>4.3 Storage of reserve food in seeds.</p>	

Course Outcomes: The student will be able to--

1. know the concept of Seed Technology and analyze the role in human welfare.
2. know about reproductive biology of plants.
3. learn basic concepts of plant embryology and its importance.
4. basic knowledge about major crop families.

Reference Books:

1. Bhojwani S. S., and Bhatnagar S. P., 1999. Embryology of Angiosperms, New Delhi: Vikas Publishing Pvt. Ltd.
2. ICAR, Hand book of Agriculture, New Delhi.
3. Jha D. K., Seed Pathology, New Delhi: Vikas Publishing House Pvt. Ltd.
4. Joshi A. K., and Singh B. D., 2017. Seed Science and Technology. New Delhi: Kalyani Publishers.
5. Khan A. A. 1977. Physiology and Biochemistry of Seed Dormancy and Germination, North Holland, Amsterdam,
6. Maheshwari P., 1950. An Introduction to Embryology of Angiosperms, New York: McGraw Hill Book Co.
7. Mondal S. S., 2009. Seed Production of field crops, New Delhi: New India Publishers Agency.
8. Singh B. D., 2018. Plant Breeding: Principles and Methodology, New Delhi: Kalyani Publishers.
9. Singh, Pande and Jain, 2019. A text book of Botany Angiosperms, New Delhi: Rastogi publication.

Seed Technology (Major)

Course-II (BST 112): Fundamentals of Seed Technology

Course Objectives: Students will be able to--

1. understand the basic knowledge about Fundamentals of seed Technology.
2. imbibe the knowledge of different seed types.
3. impart the knowledge about principles of Seed Development.
4. impart the knowledge about seed viability.

Credits (02)	Course-II (BST 112) Fundamentals of Seed Technology	No. of hours per unit
Unit I	Seed Technology and its role	07
	1.1 Seed Technology- Concept and Objective: Concept of Seed and Grain. 1.2 Types of seed, Role of Seed Technology. 1.3 Scope of seed technology in employment generation. 1.4 Seed Industry scenario in India. Seed industry & global market.	
Unit II	Structure of flower and seed development	08
	2.1 Floral structure in relation to seed development, Microsporogenesis and Megasporogenesis. 2.2 Types and mechanism, Self- incompatibility and male sterility. Agencies for pollination. 2.3 Seed Development, Seed coat structure and development. External and internal features of monocot and dicot seeds, Seed Dispersal.	
Unit III	Seed Dormancy and its Germination	08
	3.1 Seed germination; Types of Seed germination (epigeal and hypogeal). 3.2 Physiological process during seed germination; Factors affecting to seed germination.	

	<p>3.3 Seed dormancy- types, significance, mechanism (endogenous and exogenous).</p> <p>3.4 Factors regulating seed dormancy, Methods of breaking dormancy, Genetic control of seed dormancy.</p> <p>3.5 Role of phytochrome and PGRs</p>	
Unit IV	Seed Viability and Seed Vigour	07
	<p>4.1 Seed viability, causes for loss of seed viability.</p> <p>4.2 Seed vigour- importance and underlying genetic mechanism.</p> <p>4.3 Physiological basis of seed vigour. Seed ageing.</p> <p>4.4 Physiology of seed deterioration; seed viability theories in relation to crop performance and yield.</p>	

Course Outcomes: The student will be able to-----

1. learn about concept of seed technology and objective.
2. learn floral structure in relation to seed development.
3. get knowledge about Types of seed germination.
4. get knowledge of Seed viability and Seed vigor.

Reference Books:

1. Agrawal P. K., and Dadlani M. 1995. Techniques in Seed Science and Technology. 2nd ed. New Delhi: South Asian Publication,
2. Agrawal, R. L. 1997. Seed Technology. 2nd ed. New Delhi: Oxford & IBH Publ. Co. Daryaganj,
3. Bhojwani, S. S., and Bhatnagar, S. P. 2000. The Embryology of Angiosperms 4th ed., New Delhi: Vikas Publishing House,
4. Black M., Bewley D. and Halmer P. 2006. .The Encyclopedia of Seeds: Science, Technology and Uses; CABI.
5. Chhabra A. K. 2006. Practical Manual of Floral Biology of Crop Plants. Dept. of Plant Breeding, CCSHAU, Hisar.

Seed Technology (Major)

Practical Course-I (BSP 113)

Course Objectives: The student should be able to----

1. understand knowledge to students about different families.
2. practical knowledge to students about morphology of dicotyledonous and monocotyledons seeds.
3. to participate students in experiential Course-with these Practicals.
4. practical knowledge to students about seed storage and machinery management.

Credits (02)	Practical Course-I (BSP 113) (Practicals based on Theory Courses- I and II)	No. of hours per unit/credits 60 Hrs (4 Hrs/practical)
	<ol style="list-style-type: none">1. Study of family Fabaceae.2. Study of family Brassicaceae.3. Study of family Solanaceae.4. Study of family Poaceae.5. Morphology of Dicot seeds (Castor and Groundnut).6. Morphology of Monocot seeds (Maize and Jowar).7. Morphological study of any two varieties of the following crops – Soybean, Sugarcane, Jowar, Wheat.8. Study of floral biology of monocots.9. Study of floral biology of dicots.10. Study of pollen germination by sucrose solution.11. Study of Pollen viability.12. Vigour Tests (Brick gravel, Course-piercing, Accelerated Aging and Vigour index)13. Different germination tests by using Course-towel and petridish method.	

	<p>14. Methods of breaking seed dormancy.</p> <p>15. Visit to Botanical Garden.</p>	
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Course Outcomes: The student will be able to-----

1. observe and describe major crops in different families.
2. recognize the difference between monocot and dicot seeds.
3. observe the seed processing machines and their uses.
4. determine the seed moisture content by different methods.

Books Recommended:

1. Bhaskaran, M., et al. 2002. Principles of Seed Production and Quality Control. Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore. 365.
2. Bindra D. S. Plant Protection and Equipment's. New Delhi: Oxford and IBH Publishing Company.
3. Carl W.H. 1980. Drying. Farm Crops. Westport CT: Avi Publishing Company, Inc.
4. Chakravarty A. 1988. Post-Harvest Technology and Cereals, Pulses & Oil Seeds Unit II. New Delhi: Oxford and IBH Publishing Company,
5. Gregg B.R., et al. Seed Processing. New Delhi: National Seeds Corporation, 1970.
6. Henderson S. M., Perry R., 1976. Agricultural Process Engineering. 5th ed Unit III. A Westport CT: AVI Publishing Company, Inc.
7. Joshi A. K., Singh B. D., 2017. .Seed Science and Technology. New Delhi: Kalyani Publishers.
8. Khare D., Bhale M. S. 2014. Seed Technology. 2nd ed. Jodhpur: Scientific Publisher.

Seed Technology (Minor)
Course-I (BST 114): Crop wild Relatives

Course Objectives: The student should be able to----

1. understand the basic knowledge about crop wild relatives.
2. imbibe the knowledge of different centers of origin.
3. knowledge about principles of crop wild relatives.
4. encourage students to think about various crop plants.

Credits (02)	Course-I (BST 114): Crop wild Relatives	No. of hours per unit
Unit I	Centers of origin	07
	1.1 Vavilov centers 1.2 Diversity of crop wild relatives 1.3 Natural relatives of domesticated crop plants. 1.4 Centers of origin in India value-added products	
Unit II	Wild relatives of Crop plants	08
	2.1 Source of Desirable Landraces 2.2 Collection and Conservation 2.3 Concerns and Future Thrusts 2.4 Cereals: Rice, Maize, Sorghum, Pearl millet, finger millet etc. 2.5 Pulses: Pigeon pea, Urd bean, Black gram, Mung bean, Cowpea, Soybean etc. 2.6 Oil Seeds: Groundnut, Castor, Sesame, Sunflower.	
Unit III	Wild relatives of Fodder and Cash crops	08
	3.1 Collection and Conservation. 3.2 Concerns and Future Thrusts. 3.3 Fodders: Berseem, Lucerne, rice bean. 3.4 Cash crops: Sugarcane, Cotton, Tobacco, Banana.	
Unit IV	Wild relatives of Vegetable and horticultural crops	07
	4.1 Collection and Conservation,	

	4.2 Concerns and Future Thrusts, 4.3 Vegetable: Ridge gourd, bottle gourd, Snake gourd, Bitter gourd 4.4 Horticultural crops: Mango, Cashew nut, Citrus, Pomegranate	
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Course Outcomes: The student will be able to-----

1. know the basic concepts of Crop wild relatives.
2. discuss industrial applications of plant resources.
3. know and explain Wild relatives in different Cereals, Pulses and Oil Seeds.
4. understand Source of Desirable Landraces for breeding program.

Reference Books:

1. Gregg B. R. et. al. 1970. Seed Processing. New Delhi: National Seeds Corporation,
2. Henderson S. M., Perry R. 1976. Agricultural Process Engineering. 5th ed. Unit III. A Westport CT: Avishkar Publishing Company, Inc,
3. ICAR. Handbook of Agriculture. 6th ed. Unit I to Unit IV. New Delhi: 2017. . Indian Council of Agricultural Research,
4. Joshi A. K., Singh B. D., 2017. Seed Science and Technology. New Delhi: Kalyani Publishers.
5. Khare D., Bhale 2014. M. S. Seed Technology. 2nd ed. Jodhpur: Scientific Publisher,

Seed Technology (Minor)

Course-II (BST 115): Techniques of Seed processing and preservation

Course Objectives: The student should be able to----

1. understand the basic knowledge about Seeds processing.
2. imbibe the knowledge of different conventional methods of seed processing and drying.
3. knowledge about principles of seed storage and preservation.
4. knowledge about cryopreservation.

Credits (02)	Course-II (BST 115) Techniques of Seed processing and preservation	No. of hours per unit
Unit I	Fundamentals of Seed processing	07
	1.1 Introduction to the Science of Seed Technology: its importance and Scope. 1.2 Introduction, objectives and Importance of seed processing. 1.3 Physical characteristics used to separate seeds. 1.4 Post-harvest process: seed cleaning (wet and dry cleaning), Traditional methods (winnowing, sieving).	
Unit II	Seed Processing Equipment's	08
	2.1 Principle, construction, working and functions: 1. Scalper debearder, scarifier, huller, Maize Scarifier and Sheller, Seed cleaner and grader. 2. Screen cleaners, specific gravity separator. 3. Indented cylinder, velvet-spiral-disc separators, colour sorter. 4. Seed blending.	
Unit III	Seed Drying: Concept, Method and Significance	08
	3.1 Seed drying: concept and importance of Seed drying. 3.2 Methods of seed drying (natural and artificial methods), advantages of mechanical drying equipment's dehumidification its impact on seed quality.	

	<p>3.3 Moisture content, Orthodox / recalcitrant seeds, methods of seed moisture measurements, Relative humidity and Equilibrium.</p> <p>3.4 Factors affecting to seed drying, Methods of maintaining safe seed moisture content, Methods to minimize the loss of seed vigour and viability during storage.</p>	
Unit IV	Seed storage and preservation	07
	<p>4.1 Seed storage: Structures and their management.</p> <p>4.2 Storage methods and godown sanitation (disinfestations/fumigation of storage chamber), storage pest and their managements</p> <p>4.3 Factors influencing storage losses, Storage problems of recalcitrant seeds and their conservation</p> <p>4.4 Seed preservation: concept, methods (dry and moist) and importance.</p> <p>4.5 Method of Seed preservation: Cryopreservation</p>	

Course Outcomes: The student will be able to-----

1. explain mechanism of seed processing equipment.
2. describe traditional techniques of seed cleaning and its importance.
3. understand importance of seed processing equipment's.
4. understand and describe the technique Cryopreservation.

Reference Books:

1. Bhaskaran, M., et al. 2002. Principles of Seed Production and Quality Control. Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore,
2. Carl W.H. 1980. Drying. Farm Crops. Westport CT: AVI Publishing Company, Inc.
3. Chakravarty A. 1988. Post-Harvest Technology and Cereals, Pulses & Oil Seeds. Unit II. New Delhi: Oxford and IBH Publishing Company,
4. Christina Walters, James Wesley-Smith, Jennifer Crane, Lisa M. Hill, Pawel Chmielarz, Norman W. Pammenter et al. 1997. Cryopreservation of Recalcitrant (i.e. Desiccation-Sensitive) Seeds Pages 465-484. Gardening in India. Lancaster, P., New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.

5. Gregg B.R. et al. 1970. Seed Processing. New Delhi: National Seeds Corporation,
6. Hugh W. Pritchard, Jayanthi Nadarajan. 1997. Cryopreservation of Orthodox (Desiccation Tolerant) Seeds. Pages 485-501. Gardening in India. Lancaster, P., New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
7. Joshi A.K., Singh B.D. 2005. Seed Science and Technology. New Delhi: Kalyani Publishers,
8. Khare D., Bhale M. S. 2014. Seed Technology. 2nd ed. Jodhpur: Scientific Publisher,
9. Singh H., Bindra O. S., 1971. Pesticide Application Equipment's, New Delhi: Oxford and IBH Publishing Company,

Seed Technology

Practical Course-I (BSP - 116)

Course Objectives: The student should be able to----

1. practical knowledge to students about crop plants.
2. practical knowledge to students about different centers of origin.
3. participate students in experiential Course-with these Practical's.
4. practical knowledge to students about seed storage and preservation.

Credits (02)	Practical Course-I (BSP 116) (Practicals based on Theory Courses- I and II)	No. of hours per unit/credits 60 hrs (4 hrs/practical)
	<ol style="list-style-type: none">1. Vavilov Centers of origin.2. Study of Cereals and Pulses (any two).3. Study of Oil Seeds (any two).4. Study of Vegetables (any two).5. Study of Fodder plant: Berseem, Lucerne, rice bean etc. (any two)6. Study of Cash crops (any two).7. Study of Horticultural crops (any two).8. Study of different types of seeds (Orthodox, intermediate and recalcitrant seeds).9. Study the conventional methods of seed cleaning.10. Study of seed processing machines (pre-cleaner, Maize Sheller & dehusker Scalper debearder, scarifier, huller).11. Study of threshing machine and its use.12. Effect of temperature, moisture and length of storage on seed viability.13. Study of Seed Preservation Method (Cryopreservation).	

	14. Fumigation-principle and practical application.	
	15. Visit to Seed Bank.	

Course Outcome: The student will be able to-----

1. observe and describe different crop plants.
2. identify the centers of origin.
3. recognize types of seeds.
4. describe seed storage and preservation.

Reference Books:

1. Chakravarty A. 1988. Post-Harvest Technology and cereals, pulses & oil seeds. Unit II. New Delhi: Oxford and IBH Publishing Company.
2. Gregg B.R. et al. 1970. Seed Processing. New Delhi: National Seeds Corporation..
3. Joshi A.K., Singh B.D. 2005. Seed Science and Technology. New Delhi: Kalyani Publishers.
4. Khare D., Bhale M. S. 2014. Seed Technology. 2nd ed. Jodhpur: Scientific Publisher.
5. Christina Walters, James Wesley-Smith, Jennifer Crane, Lisa M. Hill, Pawel Chmielarz, Norman W. Pammenter et al. 1997. Cryopreservation of Recalcitrant (i.e. Desiccation-Sensitive) Seeds Pages 465-484. Gardening in India. Lancaster, P., New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
6. Hugh W. Pritchard, Jayanthi Nadarajan. 1997. Cryopreservation of Orthodox (Desiccation Tolerant) Seeds. Pages 485-501. Gardening in India. Lancaster, P., New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
7. ICAR. Handbook of Agriculture. 6th ed. New Delhi: 2017. Indian Council of Agricultural Research.

Seed Technology (Open Elective)
Course-I (BST 117): Seed Preservation

Course Objectives: The student should be able to----

1. understand the basic knowledge about seed preservation.
2. imbibe the knowledge of different seed preservation.
3. to impart the knowledge about principles of seed preservation.
4. to impart the knowledge about how to develop seed preservation methods.

Credits (02)	Course-I (BST 117) Seed Preservation	No. of hours per unit
Unit I	Collection of Native Seeds	07
	1.1 Identify suitable seed collection sites. 1.2 Collect seeds from appropriate habitat. 1.3 Native seeds of domesticated crop plants. 1.4 Plantation of native seeds as street trees, landscaping, etc. for Restoration.	
Unit II	Awareness about Seed Collection and Harvesting	08
	2.1 Communicate with local people about Seed Collection 2.2 Before collection identify the species, Collection and conservation. 2.3 Planning of seed collection, Rare plant propagation. 2.4 Principles and practices of seed harvesting, Threshing equipment. 2.5 Dry seed harvesting, Wet seed harvesting	
Unit III	Seed processing and handling	08
	3.1 Seed cleaning equipment 3.2 Winnowing equipment. 3.3 Drying seeds for long-term storage 3.4 Precautions during seed drying.	
Unit IV	Seed storage and preservation	07
	4.1 Seed storage: Structures and their management. 4.2 Storage methods and godown sanitation (disinfestations /	

	<p>fumigation of storage chamber), storage pest and their managements.</p> <p>4.3 Factors influencing storage losses, Storage problems of recalcitrant seeds and their conservation</p> <p>4.4 Seed preservation: concept, methods (dry and moist) and importance.</p>	
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Course Outcomes: The student will be able to-----

1. explain the Basic information of Seed.
2. explain Methods of seed drying.
3. understand seed cleaning equipment's and their functions.
4. understand Management of seed bank.

Reference Books:

1. Copeland, L. O. 1976. Principles of Seed Science and Technology. Burgess Publishing Co., Minneapolis, MN.
2. Dawson, I., Were, J. 1997. Collecting Germplasm From Trees Some Guidelines. *Agroforestry Today*. 9(2): 6–9.
3. Deno, N. 1993. Seed Germination: and Practice. 2nd ed. State College, PA.
4. Dreesen, D. 2004. Tumbling for Seed Cleaning and Conditioning. *Native Plants Journal*. 5: 52– 54.
5. Dremann, C. 2003. Observations on Bromus Carinatus and Elymus Glaucus Seed Storage and Longevity. *Native Plants Journal* 4:61-64.
6. Dumroese, R.K., Landis, T.D. and Wenny, D.L. : 1998. Raising Forest Tree Seedlings At Home: Simple Methods for Growing Conifers of the Pacific Northwest From Seeds. Moscow, ID: Idaho Forest, Wildlife and Range Experiment Station. 56
7. Dumroese, R.K., Luna, T., Landis, T.D. 2008. Nursery Manual for Native Plants. Vol. I, A guide for tribal nurseries. Agriculture.
8. Flores, E.M. 2002. Seed Biology. In: Vozzo, J.A., ed. The tropical tree seed manual. Agriculture Handbook 721. Washington, DC: U.S. Department of Agriculture, Forest Service. 13–118.
9. Grabe, D. F., Isely, D. 1969. Seed Storage in Moisture-Resistant Packages. *Seed World* 4.
10. Harrington, J.F. 1954. .Vegetable Seed Germination Temperatures. Agricultural Extension leaflet, University of California, Davis.

Seed Technology (Open Elective)
Course-II (BST 118): Seed Bank formation

Course Objectives: The student should be able to----

1. understand the basic knowledge about Basic information of Seed.
2. imbibe the knowledge of seed storage.
3. knowledge about principles of seed drying.
4. knowledge about Seed cleaning equipment's.

Credits (02)	Course-II (BST 118) Seed bank formation	No. of hours per unit
Unit I	Seed structure and its storage	07
	1.1 Basic information of Seed: An embryo, a seed coat. 1.2 Dicot seed and monocot seed, Morphology of Seeds in dicot and monocot. 1.3 Methods of seed storage- traditional and modern 1.4 Concept of Seed bank, Principles of seed bank. Benefit of seed bank.	
Unit II	Seed drying methods and its viability	08
	2.1 Methods of seed drying, relative humidity and moisture content of seed. 2.2 Seed viability in important agricultural and horticultural crops, viability equations and application of monograph. 2.3 Proper methods of seed storage. Seed viability, Seed germination	
Unit III	Seed Cleaning instruments	08
	3.1 Seed cleaning equipment's and their functions 3.2 Functions of seed cleaning machines- Scalper debearder,	

	scarifier, huller, seed cleaner and grader, colour sorter, specific gravity separator. 3.3 Seed blinding, delinting machines.	
Unit IV	Seed bank and its management	07
	4.1 Seed bank – Government policies, Management of seed bank. 4.2 Seed bank data management, Germination testing in the nursery. 4.3 Marketing of seeds and its types.	

Course Outcomes: The student will be able to-----

1. explain the methods of seed storage.
2. describe the methods of seed drying.
3. understand the functions of seed cleaning machine.
4. understand the management of Seed Bank.

Reference Books:

1. Hong, T.D., and R.H. Ellis. 1996. A protocol to determine seed storage behaviour. IPGRI Technical Bulletin No. 1. Eds. Engels, J.M.M., Toll, J. vol. International Plant Genetic Resources Institute, Rome, Italy.
2. Ballesteros, D. et al. 2018. Longevity of preserved germplasm: The temperature dependency of aging reactions in glassy matrices of dried fern spores. *Plant and Cell Physiology*, 60(2), 376– 392.
3. Ballesteros, D., Hill, L. M., and Walters, C. 2017. Variation of desiccation tolerance and longevity in fern spores. *Journal of Plant Physiology*, 211, 53– 62.

Seed Technology (Open Elective)

Practical Course-I (BSP- 119)

Course Objectives: The student should be able to----

1. introduce students to the different types of seeds.
2. explain the seed drying methods.
3. knowledge about landscaping and gardening.
4. knowledge and skills required for seed storage.

Credits	Practical Course-I (BSP-119) (Practicals based on Courses I and II)	No. of hours per unit 60Hrs.
	<ol style="list-style-type: none">1. Collection of different types of seed from its habitat.2. Cleaning of various types of seeds by physical purity analysis.3. Drying of seeds by different methods.4. Preservation of various types of seeds by different methods.5. Study of Dicot seeds.6. Study of monocot seeds.7. Identification of tools and implements used in landscaping gardening.8. Methods of seed storage- traditional and modern.9. Collection of different types of seeds for seed bank formation.10. Study of seed viability in agricultural crops.11. Study of seed viability in horticultural crops.12. & 13. Methods of seed drying- Sun drying (Natural Drying), Forced air drying (Mechanical drying), Use of desiccants (Chemical) for drying.14. &15. Study of seed cleaning machines- Scalper debearder, scarifier, huller, seed cleaner and grader, colour sorter, specific	

	gravity (any available).	
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Course Outcomes: The student will be able to-----

1. demonstrate different methods required for seed drying.
2. perform routine practices to maintain garden.
3. use different specialized tests for seed viability testing.
4. describe traditional methods for seed storage.

Reference Books:

1. Ballesteros, D. et al. 2018. Longevity of preserved germplasm: The temperature dependency of aging reactions in glassy matrices of dried fern spores. *Plant and Cell Physiology*, 60(2), 376– 392.
2. Ballesteros, D., Hill, L. M., and Walters, C. 2017. Variation of desiccation tolerance and longevity in fern spores. *Journal of Plant Physiology*, 211, 53– 62.
3. Hong, T.D., R.H. Ellis. 1996. A protocol to determine seed storage behaviour. IPGRI Technical Bulletin No. 1. Eds. Engels, J.M.M., Toll, J. vol. International Plant Genetic Resources Institute, Rome, Italy.

Seed Technology (IKS) (Indian Knowledge System)

Course-I (IKS 101): Indian Agriculture

Course Objectives: The student should be able to----

1. impart knowledge of traditional agricultural practices followed in India.
2. develop awareness about the glorious history of Indian agriculture.
3. make the students knowledgeable about ancient agricultural techniques.
4. empower the students with the ability to compare ancient, medieval and modern agriculture trends.

Credit (02)	Course-I (IKS 101): Indian Agriculture	No. of hours per unit
Unit I:	History of Indian Agriculture	(5)
	1.1 Introduction and importance of Agriculture in India 1.2 History of Indian agriculture: The significance of agriculture and irrigation as emphasized in the Indian Mythological texts like Ramayana, Mahabharata and other. Mention of Indian agriculture by Greek historians and later travelers.	
Unit II	Ancient Irrigation Techniques	(5)
	2.1 Significance of Agriculture and irrigation for the Kings of Indian tradition. 2.2 Major water bodies of ancient times. The Ery system of south India.	
Unit III	Indian Agriculture Technologies	(5)
	3.1 Excellence of Indian agricultural technologies as observed by more recent European observers. 3.2 Productivity of Indian agriculture in medieval Thanjavur and eighteenth-century Allahabad, Chengalpattu, etc.	
Unit IV	Agriculture and Indian Society	(5)
	4.1 Indian attitude towards agriculture in ancient times. 4.2 Indian attitude towards agriculture in medieval times. 4.3 Indian attitude towards agriculture in modern times.	

Course Outcomes: The student will be able to-----

1. discuss about ancient Indian agriculture and compare the different ancient agriculture traditions with the current scenario.
2. explain the irrigation techniques in India and demonstrate the various irrigation techniques followed in India.
3. evaluate the effectiveness of different agriculture technologies implemented in India.
4. compare the Indian attitude towards agriculture during the history of India.

Reference Books:

1. Agarwal, A., Narain, S. Dying Wisdom: Rise, 1997. Fall and Potential of India Traditional Water-Harvesting Systems. New Delhi: Centre for Science and Environment,
2. Ayangarya, V. S. Lokopakara 2006. (For the Benefit of People) - An Ancient Text on Indian Agriculture. Asian Agri-History Foundation, India.
3. Basu, R. N., Bose, T. K. and Chakraborty, C. S. 2017. History of Science in India - Agricultural Science. Vol V. The National Academy of Science, India (NASI) & The Ramakrishna Mission Institute of Culture, India.
4. Bhadani, B. L. 2012. Water Harvesting, Conservation and Irrigation in Mewar (AD 800-1700). New Delhi: Manohar Publishers & Distributors.
5. Bunce, F. W. 2013. The Iconography of Water: Well and Tank Forms of the Indian Subcontinent. New Delhi: D. K. Printworld Pvt. Ltd.
6. Chakravarty, K. K., Badam and G. L., 2006. Paranjpye, V. Traditional Water Management Systems of India. New Delhi: Aryan Books International.
7. Mukundan, T. M. 2005. The Ery Systems of South India. Chennai: Akash Ganga Trust,
8. Srinivasan, T. M. 1991. Irrigation and Water Supply: South India, 200 BC to 1600 AD. Hyderabad: South Asia Books.

Seed Technology (CC) (Cocurricular Course)

Not Me But You

Course Name: National Service Scheme-Communitymobilization

Structure of NSS Course:

Duration	Theory Periods	Practical Periods	Total Periods	Credits
1 Year	10	30	40	2

Semester – I Course objectives: Students should be able to...

1. know the basic concepts of NSS.
2. realize the importance of NSS in Life.
3. inculcate the awareness and preparation of basic of social important goals.
4. improve personality.

Credits (Total Credits 1)	Name of the units	No. of hours per unit
Unit – I	Introduction to Basic Concepts of NSS 1.1 History, philosophy, aims and objectives of NSS. 1.2 Emblem, flag, motto, song, badge etc. 1.3 Organisational structure, roles and responsibilities of various NSS functionaries.	(04)
Unit – II	Community mobilization 1.1 Mapping of community stakeholders. 1.2 Designing the message in the context of the problem and the culture of the community. 1.3 Indian Tradition of volunteerism, Needs and importance of volunteerism. 1.4 Motivation and constraints of volunteerism, shramdan as part of volunteerism. 1.5 Swatch Bharat. Awareness in blood donation/ tree plantation/special camps etc.	(06)

Course outcomes: After completion of the course students will be able to...

1. explain the importance of National Service Scheme.
2. participate in social activities like shramdan.
3. categorize youth according to their abilities.
4. support in personality development for colleagues.

Reference Books:

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. University of Mumbai National Service Scheme Manual 2009.
3. Avhan Chancellor's Brigade – NSS Wing, Training camp on Disaster Preparedness Guidelines, March 2012
4. Rashtriya Seva Yojana Sankalpana – Prof. Dr. Sankay Chakane, Dr. Pramod Pabrekar, Diamond Publication, Pune

Course Name: National Service Scheme

Practical Syllabus (30Hrs)

Couse objectives: Students should be able to...

1. understand the values of personality development and social service.
2. develop the skill in social awareness.

Credits (Total Credits 1)	Name of the Practicals	No. of hours per unit (30 hr)
1	Awareness about the motto of the National Service Scheme.	(04)
2	Aware about National Service Scheme awards.	(04)
3	Participation in National Service Scheme day to day activities.	(06)
4	Achievements of the National Service Scheme Social service best volunteers award/ national wards / state level awards/ university awards etc.	(10)
5	Project/ field visits survey/ industrial visit/ ashram visit, varri visit	(06)

Learning Outcomes: After completion of the practical student will able to...

1. Acquire skills required for the personality development.
2. Show the behaviour in particulat social work.

Reference Books:

1. National Service Scheme Manual for NSS District Coordinators, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya,
2. Annual report of National Service Scheme (NSS) published by Dept. of Higher and Technical Education, Mantralaya,
3. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA-Socio and cultural guidelines
4. Case material as a Training Aid for Field Workers, Gurmeet Hans.
5. Social service opportunities in hospitals, Kapil K. Krishnan, TISS
6. New Trends in NSS, Research papers published by University of Pune "*Ministry of Youth Affairs and Sports*". 13 August 2014.

Karmaveer Bhaurao Patil University, Satara
Yashavantrao Chavan Institute of Science, Satara
Syllabus to be introduced from June 2023

Bachelor of Science (B. Sc.) Part - I

Seed Technology (Major)

Semester II

Course-III (BST 121): Instrumentation and Techniques in Seed Technology

Course Objectives: The student should be able to----

1. understand the basic knowledge about instrumentation.
2. imbibe the knowledge of different seed processing machines.
3. impart the knowledge about principles of seed treatment, seed processing plants.
4. know about the seed storage and packaging.

Credits (02)	Course-III (BST 121) Instrumentation and Techniques in Seed Technology	No. of hours per unit
Unit I	Instrumentation for Seed processing	07
	1.1 Concept and objectives of seed processing: concept and importance, Basic flow pattern, seed processing pathway of seed improvement, physical characteristics used to separate seeds. 1.2 Instruments for seeds processing: Scalper, Debarred, Maize Scarifier and Sheller, licensing of machines. 1.3 Seed drying: advantages of seed drying, moisture content, Orthodox/recalcitrant methods of seed moisture measurements, of seed drying (wet and dry seeds), advantages of mechanical drying equipment's dehumidification and drying of heat sensitive seeds, relative humidity and equilibrium, moisture content of seeds.	
Unit II	Seed processing machines	08
	2.1 Principle, construction, working, adjustments, cleaning and uses of seed processing machines: <ol style="list-style-type: none"> i. Air screen cleaner cum grader ii. Specific gravity separator, aspirators, pneumatic aspirators, stoner iii. Roll mill iv. Magnetic separators, Spiral separators, dropper best separator, electrostatic separators. 	

Unit III	Seed treatment and Seed processing plant	08
	3.1 Seed Treatment: Principle, construction, working, adjustments and uses of slurry seed treater, mist-o-matic seed treater, storage and labeling of treated seeds, seed user's safety.	
	3.2 Seed processing plant: Site selection, layout of machines in a seed processing plant for efficient product, seeds in post-harvest phase, conservation of energy and production. 3.3 Seed conveyors and elevator: bucket elevator, belt conveyor, screen conveyor, oscillation conveyor, pneumatic conveyor	
Unit IV	Seed storage and packing	07
	4.1 Seed storage: Structures and their management. 4.2 Packing and marketing of seeds- Bagger, weigher, bag closing, portable and conveyor type of bag closer, labeling and maintaining lot identity, lot numbers, seed pellets, handling and stacking, maintenance of seed processing records.	

Course Outcomes: The student will be able to-----

1. know the concept and objectives of seed processing.
2. know the various techniques of seed packaging.
3. learn principle, construction, working, cleaning and uses of seed processing machines.
4. know the different equipments used for seed processing.

Reference Books:

1. Chakraverty A. 1988. Post-Harvest Technology of Cereals, Pulses & Oil Seeds, Publisher: New Delhi: Oxford and IBH Publishing Company,
2. Gregg B. R. et al. 1970. Seed Processing. New Delhi: National Seeds Corporation,
3. Hall, C. W. 1980. Drying and Storage of Agricultural Crops, Westport, conn.: AVI Publishing Company,
4. Henderson S. M., Perry R1976. Agricultural Process Engineering. 5th Ed. A Westport CT: AVI Publishing Company, Inc,
5. ICAR. 2017. Handbook of Agriculture. 6th ed. New Delhi: Indian Council of Agricultural Research, Joshi A. K., Singh B. D. 2005. Seed Science and Technology. New Delhi: Kalyani Publishers,

6. Khare D., Bhale M. S. 2023. Seed Technology. 2nd ed. Jodhpur: Scientific Publisher,
7. Singh H., Bindra O. S., 1971. Pesticide Application Equipments, New Delhi: Oxford and IBH Publishing Company,

Seed Technology (Major)
Course-IV (BST 122) Vegetable seed Production

Course Objectives: Students will be able to--

1. understand the basic knowledge of different aspects of hybrid vegetable seed production.
2. imbibe the knowledge of hybridization techniques.
3. to impart the knowledge about breeding and recent advances of vegetable seed production.
4. make the students aware of the vegetable crops.

Credits (02)	Course-IV (BST 122)Vegetable seed Production	No. of hours per unit
Unit I	Vegetable seed Production	07
	1.1 Historical account, present status, importance and future of vegetable seed production, objectives of vegetable breeding.	
	1.2 Classification of vegetable crops- Root crops, bulb crops leafy crops flowering crops and fruit crops.	
	1.3 Role of Apomixis in Vegetable seed production.	
Unit II	Techniques in hybridization	08
	2.1 Pollination: Types, natural cross pollination, extent of it in vegetable crops, its role in vegetable seed production and pollination vectors in vegetable crop.	
	2.2 Hybridization: Introduction, definition and role	
	2.3 Steps involved in hybridization (emasculation, pollination, bagging tagging)	
	2.4 Simple, back and test cross.	
Unit III	Breeding and Recent Advances	08
	3.1 Introduction: Definition, collection, maintenance, evaluation storage, role and utilization.	
	3.2 Selection Methods (Pedigree and Bulk): Definition, methods, and achievements.	
	3.3 Recent advances in vegetable seed production	

Unit IV	Requirements of Vegetable Seed Production	07
	Seed Production of Fruit crop, Root Crop and Bulb crop with respect to following steps: a) Land requirement b) Seedling/Root production c) Nursery management d) Planting e) Cultural practices f) Breeding methods used g) Plant protection h) Seed harvesting i) Seed drying j) Seed grading k) Seed extraction (Wet - dry methods)	

Course Outcomes: The student will be able to-----

1. learn about concept of different aspects of hybrid vegetable seed production.
2. students are able to learn natural cross pollination.
3. understand recent advances in vegetable seed production of hybridization techniques.
4. get knowledge of aware about the breeding and recent advances of vegetable seed production.

Reference Books:

1. Agrawal R. L. 1998. Fundamentals of Plant Breeding and Hybrid Seed Production. New Delhi: Oxford and IBH Publishing Company Pvt. Ltd,
2. Singh C. B 2014. Handbook of Seed Testing. New Delhi: Anmol Publication Pvt. Ltd,
3. Prem Singh A. 2016. Vegetable Breeding- Production and Seed Production. Ludhiana: Kalyani Publication,
4. Chopra V. L 2005. Plant Breeding and Practice. New Delhi: Oxford and IBH Publishing Company Pvt. Ltd,
5. Fagaria M. S., Choudhary B. R., Dhaka R. S. 2005. Vegetable Crops Production Technology. New Delhi: Kalyani Publisher,
6. Khare D., Bhale M. S. 2016. Seed Technology. 2nd ed. Jodhpur: Scientific Publisher,
7. Prasad R. 2015. Textbook of Field Crop Production. New Delhi: Directorate of information and Publication of agriculture,
8. Ram H. H., Singh H. G. 1993. Crop Breeding and Genetics. New Delhi: Kalyani Publisher,
9. Sharma J. R. 1994. Principles and Practice of Plant Breeding. New Delhi: Tata-McGraw Hill Publishing Company Ltd,
10. Singh B. D. 2006. Plant Breeding: Principles and Methods. Ludhiana: Kalyani Publication,

Seed Technology (Major)

Practical Course-II (BSP 123)

Course Objectives: The student should be able to----

1. to give practical knowledge to students about floral biology of monocots and dicots.
2. to give practical knowledge to students about Pollen germination, pollen sterility and germination tests.
3. to participate students in experiential Course-with these Practicals.
4. to give practical knowledge to students about hybridization techniques.

Credits (02)	Practical Course-II (BSP 123) Practicals based on Theory Course-III and IV	No. of hours per unit/credits 60 Hrs. (4 hrs/practical)
	<ol style="list-style-type: none">1. Study of bucket elevator, screw conveyers and pneumatic elevators.2. Study of threshing machine and its use.3. Fumigation-principle and practical application.4. Demonstration & handling of stereo binocular microscope.5. Study of seed processing machines (air screen cleaner cum grader, magnetic separator, specific gravity separator, seed treatment machines).6. Measurement of seed moisture content by OSWA & moisture meter/ oven drying method.7. Visits to warehouse, godowns and market.8. Visits to seed processing units in Satara.9. Study of Hybridization technique with respect to any crop.10. Study of self-pollinated crops.11. Study of cross-pollinated crops.	

	<p>12. Study of synthesis of artificial seed.</p> <p>13. Emasculation of various crops.</p> <p>14. Identification of weed and other crop seeds as per specific crops.</p> <p>15. Study of Fruit crop- Tomato; Root crop- Radish; Bulb crop- Onion</p> <p>16. Visit to Nursery to understand about horticultural crops.</p>	
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Course Outcome: The student will be able to-----

1. observe and describe floral biology of monocots and dicots.
2. observe Pollen germination, pollen sterility and germination tests.
3. recognize difference between vegetable crops.
4. prepare artificial seeds.

Reference Books

1. Chopra V. L. 2005. Plant Breeding and Practices. New Delhi: Oxford and IBH Publishing Company Pvt. Ltd,
2. Fageria M. S., Choudhary B. R., Dhaka R. S. 2003. Vegetable Crops Production Technology. New Delhi: Kalyani Publisher,
3. Bench ALR & Sanchez RA. 2004. .Handbook of Seed Physiology. Food Product Press,
4. Bewley JD & Black M. 1982. Physiology and Biochemistry of seeds in Relation to Germination.Vols. I, II. Springer Verlag,

Seed Technology (Minor)
Course-III (BST124): Seed Quality control

Course Objectives: The student should be able to----

1. understand the basic knowledge about Quality control.
2. imbibe the knowledge of quality evaluation.
3. knowledge about relevance to crop performance.
4. the knowledge about seed testing.

Credits (02)	Course-III (BST 124) Seed Quality control	No. of hours per unit
Unit I	Structure of seeds and its role	08
	1.1 Seed quality: Introduction and importance. 1.2 Objectives, concept and components and their role in seedquality control. 1.3 Instruments, devices and tools used in seed testing. ISTA and its role in seed testing.	
Unit II	Study of seeds sampling in laboratory	07
	2.1 Seed Sampling: definition, objectives, seed-lot and its size; types of samples; sampling devices. 2.2 Procedure of seed sampling; Methods of preparing composite and submitted samples; sub- sampling techniques. 2.3 Receipt and registration of submitted sample in the laboratory. 2.4 Sampling in the seed testing laboratory.	
Unit III	Purity analysis and their application of Seed	08
	3.1 Physical Purity: definition, objective and procedure, weight of working samples for physical purity analysis. 3.2 Components of purity analysis, general procedure of purity analysis, Calculation and reporting of results, prescribed seed purity	

	standards 3.3 Determination of husk less seeds, Determination of weed seed and other seed by number per kilogram.	
Unit IV	Seed diseases and its study	07
	4.1 Seed health Testing: field and seed standards	
	4.2 Seed diseases: Introduction, agents of infection, symptoms, control measures. 4.3 seed quality – seed health testing and detection.	

Course Outcomes: The student will be able to-----

1. student can able to Procedure of seed sampling.
2. students can understand physical purity of seed.
3. student can explain Seed Sampling: definition and its objectives.
4. students can understand seed health testing.

Reference Books:

1. Agrawal P. K. 1993. Handbook of Seed Testing. Ministry of Agriculture, GOI, New Delhi.
2. Agrawal, R. L. 2008. Seed Technology (II nd Ed.) Oxford & IBH Publ. Co. New Delhi.
3. Copland LO and Mc Donald M B. 1996. Principles of Seed Science and Technology.
4. ISTA. 1996. International rules for seed testing. Seed Science and Technology, 24 (suppl):1- 335.
5. Kluwer. F. A. O. 1997. Quality declared seeds. (United Nations Rome.)

Seed Technology (Minor)

Course-IV (BST 125): Seed Production in Field Crops

Course Objectives: The student should be able to----

1. knowledge about seed production.
2. knowledge of pollination in plants.
3. impart the knowledge about relevance to crop performance.
4. knowledge about seed testing.

Credits (02)	Course-IV (BSP 125) Seed Production in Field Crops	No. of hours per unit
Unit I	Basic Principles of seed production	07
	1.1 Introduction, Difference between seed and crop production, Scope and importance of seed production. 1.2 Scope for seeds export, the importance of seed quality of field crops.	
Unit II	Seed Production Techniques of Cereals	08
	2.1 Self-pollinated cereals: Breeding and pollination mechanism; methods and techniques of seed production in cereals viz., Wheat, Rice. 2.2 Cross-pollinated cereals: Breeding and pollination mechanism; methods and techniques of seed production in cereals viz., Maize, Sorghum.	
Unit III	Seed Production Techniques of millets	08
	3.1 Breeding and pollination mechanism; methods and techniques of seed production of Millets (Finger millet, Foxtail millet, Proso millet, Little millet, Kodo millet and Barnyard millet) (Any four)	
Unit IV	Seed Production Techniques of pulses	07
	4.1 Breeding and pollination mechanism; methods and techniques of seed production in pulses (pigeon pea, chick pea, green gram, black gram etc.).	

Course Outcomes: The student will be able to-----

1. explain the Basic principles in seed production and importance.
2. describe Breeding and pollination mechanism in self-pollinated Plants.
3. describe Breeding and pollination mechanism in cross-pollinated cereals.

Reference Books:

1. John Wiley., Mc Donald MB Jr & Copeland LO. 1997. Seed Production: Principles and Practices. Chapman & Hall.
2. Kelly AF. 1988. Seed Production of Agricultural Crops.
3. Singhal NC 2003. Hybrid Seed Production in Field Crops. Kalyani Publication.

Seed Technology (Minor)
Practical Course-II (BSP 126)

Course Objectives: The student should be able to----

1. practical knowledge to students about identification and handling of instruments used in seed testing laboratory.
2. practical knowledge to students about germination and viability by different methods.
3. to participate students in experiential Course-with these Practicals.
4. practical knowledge to students about emasculation technique.

Credits (02)	Practical Course-II (BSP 126) Practicals based on Theory Course-III and IV	No. of hours per unit/credits 60 Hrs (4 hrs/practical)
	<ol style="list-style-type: none"> 1. Study of instruments used in seed testing laboratory. 2. Study of physical purity analysis of different crop samples. 3. Estimation of seed moisture content of different crop samples. 4. Breaking of Seed dormancy by mechanical and chemical methods. 5. Seed germination testing in different agri-horticultural crops; 6. Seed viability testing by tetrazolium test in different crops. 7. Estimation of seed moisture content by oven method. 8. Seed borne diseases (any two). 9. Study of floral biology of Self-pollinated Cereals: Wheat and Rice 10. Study of floral biology of Cross pollinated Cereals: maize and Sorghum. 11. Study of floral biology of Millets. 12. Study of floral biology of Pulses. 13. Collection of various types of millets from local areas. 	

	14. Demonstration of breeding techniques (Emasculation, Pollination, Bagging and Tagging). 15. Field visit.	
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Course Outcome: The student will be able to-----

1. describe the germination and viability methods.
2. observe and separate the different seeds by physical purity method.
3. describe the emasculation method.

Books Recommended:

1. Bhandari M. M., 2013. Practicals in Plant Breeding, Oxford & IBH Publ. Co. New Delhi.
2. Poehlman J. M., Sleper, D. A. 1995. Breeding Field Crops, Panima Publishing Corporation.
3. Schwass R. H., 1973. Seed Quality Control, Food and fertilizer technology centre.

Seed Technology (OE) (Open Elective)
Course-III (BST 127): Seed Quality testing

Course Objectives: The student should be able to----

1. impart the basic knowledge of seeds of various crops.
2. impart the knowledge of different conventional methods of seed quality testing.
3. to understand the knowledge about principles of seed storage and preservation.
4. impart the knowledge about seed vigor and viability.

Credits (02)	Course-III (BST127): Seed Quality testing	No. of hours per unit
Unit I	Fundamentals of Seed Technology	07
	1.1 Restoration. Introduction, history, importance and scope of seed Technology. 1.2 Recent trends in Seed Technology.	
Unit II	Seed Testing	08
	2.1 Seed testing equipments and their maintenance 2.2 Germination testing: Concept, objectives, Importance, definitions, requirement, methods of seedling evaluation. 2.3 Seed viability: Principle, objectives and methods of TZ test, embryo excision test. 2.4 Seed vigor testing: Concept, objectives and methods for determination of seed vigor.	
Unit III	Seed purity analysis	08
	3.1 Seed sampling and Dividing: Concept, objectives, Equipment's used e.g. Seed triers, seed dividers: procedure, handling and testing of samples. 3.2 Physical purity analysis: Concept, objectives, equipment's used in physical purity analysis, procedure, and purity components.	
Unit IV	Seed testing laboratory and organizations	07
	4.1 Layout and infrastructure, staffing and equipments.	

	<p>4.2 National seed organizations: Aim, working and role - Central Seed Committee (CSC), Central Seed Testing Laboratory (CSTL), State Seed Certification Agencies (SSCA).</p> <p>4.3 Seed testing laboratory management and functioning 4.4 Seed preservation: concept, methods (dry and moist) and importance.</p>	
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Course Outcomes: The student will be able to-----

1. student can able to understand recent trends in seed technology.
2. student can explain Seed testing equipments and their maintenance.
3. students can know about National seed organizations.
4. student can able to understand seed viability, seed vigor testing and seed germination.

Reference Books:

1. Agrawal R. L., 2008. Seed technology, Oxford and IBH Publishing Company, Pvt. Ltd.
2. Kulkarni G. M., 2015. Principles of seed technology, Kalyani Publishers.
3. Copeland, L. O 1976. Principles of Seed Science and Technology. Burgess Publishing Co., Minneapolis, MN.

Seed Technology (OE) (Open Elective)
Course-IV (BST 128): Seed certification and marketing

Course Objectives: The student should be able to----

1. understand the basic knowledge about certification and marketing.
2. imbibe the knowledge of certification and marketing.
3. to impart the knowledge about certification and marketing.
4. to impart the knowledge about certification and marketing.

Credits (02)	Course-IV (BST 128) Seed certification and marketing	No. of hours per unit
Unit I	Seed certification	07
	1.1 Concept of seed certification, History of seed certification, objectives of seed certification, eligibility for seed certification 1.2 Seed certification agencies-Seed act, control measures for seed certification Phases of seed certification 1.3 Policies of seed marketing Seed export /import,	
Unit II	Seed Production System In India	08
	2.1 Breeder Seed, Foundation Seed, Certified Seed. 2.2 Role of Public & Private Seed. 2.3 Objective of Seed Certification, Eligibility requirements for certification	
Unit III	Importance and promotion of quality of seed	08
	3.1 Importance and promotion of quality seed, formal and informal seed supply systems. 3.2 Basic concepts of marketing with special reference to seed 3.3 importance and scope of seed industry in India, major constraints/problems in seed industry/seed sector role of seed.	
Unit IV	Seed Marketing	07
	4.1 Seed marketing intelligence and product mix	

	<p>4.2 Sales promotion, distribution channels, marketing costs and margins.</p> <p>4.3 Responsibilities of seed companies and dealers under Seed Act, EXIM policies for seed trade etc.</p>	
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Course Outcomes: The student will be able to-----

1. student can explain the Basic information of seed certification.
2. student can able to understand Policies of seed marketing.
3. student can able to understand importance and scope of seed industry in India.
4. students can understand responsibilities of seed companies and dealers under Seed Act.

Reference Books:

1. Kohls R. L., Uhl J. N., 1980. *Marketing of Agricultural Products*, Macmillan Publishing Company, United States of America.
2. Mac M., Kundu K. K., Suhag K. S., 2006. *Teaching Manual on Seed Marketing and Management*, Department of Agricultural Economics CCS HAU Hisar. 67 Venugopal.
3. Dhillon B. S., et. al. 2001. *Germplasm Conservation A Compendium of Achievements*. NBPGR, New Delhi.
4. Singh G., 2004. *Plant Systematics: An Integrated Approach*. Science Publisher.

Seed Technology (Open Elective)

Practical Course-II (BSP 129)

Course Objectives: The student should be able to----

1. understand about seed germination methods.
2. know about seed testing equipments.
3. knowledge post-harvest techniques.

Credits (02)	Practical Course-II (BSP 129) Practicals based on Theory Course-III and IV	No. of hours per unit/credits 60 Hrs. (4 hr/practical)
	<ol style="list-style-type: none">1. To study of seed germination percentage by Germination Course, sand and soil method.2. To study seed viability test by different methods.3. To study seed vigor testing by physical method.4. To draw the working sample and conduct the physical purity test.5. To study the different instruments used for seed testing (seed triers).6. Seed testing laboratory in India.7. Visit to any one seed testing laboratory.8. General procedure of seed certification.9. Identification of weed and other crop seeds as per specific crops.10. Field inspection at different stages of a crop and observations recorded on contaminants and reporting of results.11. Inspection and sampling at harvesting / threshing, processing and after processing for seed law enforcement.12. Testing physical purity, germination and moisture;	

	<p>specifications for tags and labels to be used for certification purpose.</p> <p>13. Grow-out tests for pre and post-harvest quality control.</p> <p>14. Data collection from websites regarding seed organizations in India and abroad.</p> <p>15. Visits to regulatory seed testing laboratory, including plant quarantine lab and seed certification agency.</p>	
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Course Outcomes: The student will be able to-----

1. observe and describe seed quality.
2. observe seed germination and moisture.
3. recognize seed certification system.

Reference Books:

1. Martin C., Barkley D., 1961. Seed Identification Manual. Oxford BH.
2. Nema N. P., 1966. Principles of Seed Certification and Testing, Daya Publ. House Seed Act. Govt. of India, Manager Publications, G. I.O., New Delhi.

Seed Technology (SEC) (Skill Enhancement Course)
Course-I (SEC 103) Crop Improvement (Hybrid Seed Production)

Course Objectives: The student should be able to----

1. understand the basic knowledge about heterosis.
2. knowledge about principles of agricultural crops.
3. imbibe the knowledge of pollination mechanism.

Credits (02)	Course-I (SEC 103): Crop Improvement (Hybrid Seed Production)	No. of hours per unit
Unit I:	Utilization of heterosis in agricultural crops	(08)
	1.1 Heterosis: definition, expression and estimation of hybrid vigour 1.2 Utilization of heterosis in agricultural, horticultural and other crop plants for crop improvement.	
Unit II	Mechanisms and management of pollination in plants	(08)
	2.1 Pre requisites for hybrid seed production 2.2 Mechanisms and management of pollination in autogamous and allogamous crops 2.3 Genetic constitution of varieties, hybrids and basic principles in seed production.	
	Practicals	(14)
	1. Study of agronomy of crop plants. 2. Emasculation of various crops. (any two) 3. Study of pollen viability. 4. Study of pollen germination. 5. Study of pollen morphology of any two crop plants. 6-10. Project work- Identification and submission of report of local land races. 11-15. Case study on conservation status of species/ seeds in local area	

Course Outcomes: The student will be able to-----

1. student can explain Mechanisms and management of pollination.
2. students can understand techniques of hybrid seed production.

Reference Books:

1. Basra A. S., 2000. Heterosis and Hybrid Seed Production in Agricultural Crops, Food Production Press.
2. Singhal N.C., 2003. Hybrid Seed Production in Field Crops. Kalyani Publication.
3. Basavaraju G. V., Rvishankar P., and Gowdiperu S., A, 2014. Textbook of Seed Science and Technology, Kalyani Publisher.

Seed Technology (VEC) (Value Education Courses)

Digital Technology (VEC 104)

