

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

**Syllabus Under Autonomy
For
B. Sc. I (Seed Technology)**

Academic Year 2018 – 2019

Rayat Shikshan Sanstha's

Yashwantrao Chavan Institute of Science, Satara

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

1. TITLE: Seed Technology

2. YEAR OF IMPLEMENTATION: 2018 – 2019

3. PREAMBLE:

The B. Sc. Botany course under autonomy will be effective from the academic year 2018 – 2019. In that focus, 3 year B.Sc. vocational course prepared for the students. It is offered among as two theory and one practical course at B.Sc. I, at B. Sc. II and B.Sc. III it has two theory and two practical courses. The emphasis is to provide students the reliable and professional knowledge of seed production, quality control and maintenance. The course will provide opportunity of career in seed industries.

4. GENERAL OBJECTIVES OF THE COURSE:

1. To introduce the concept of new concepts in seed technology
2. To enrich students training and knowledge that would be useful in seed industries so that the farmers will get quality seeds.
3. To develop skill in practical work, experiments and laboratory materials in seed technology.
4. To help students build up a progressive and successful career in seed industry.
5. 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:

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 – I: BST 101	Seed Development and Morphology	5	4	Practical Paper – I : BSP103	4	2
		Paper – II: BST102	Plant Breeding					

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: BST 201	Seed Physiology	5	4	Practical Paper –II : BSP 203	4	2
		Paper – IV: BST 202	Seed Production					

2) Structure and titles of papers of B. Sc. Course

B. Sc. I Semester I

Paper I: Seed Development and Morphology

Paper II: Plant Breeding

Botany Practical I: Practicals based on Theory paper I and II

B. Sc. I Semester II

Paper III: Seed Physiology

Paper IV: Seed Production

Botany Practical II: Practicals based on Theory paper III and IV

3) 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

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Draft Syllabus to be introduced from June, 2018
For B. Sc. (Part I)
SEED TECHNOLOGY (Theory)
Semester I Paper I
Seed Development and Morphology

Unit 1: Introduction to Seed Technology: (10 L)

History, Aim and Role of Seed Technology.	2 L
Concept of Seed, Definition and types, difference between Seed and Grain, importance of seed.	3 L
Morphology of crop and seed for identification of varieties of following crops- Tomato, Potato, Chilly, Onion, Ginger, Jowar, Rice, Wheat, Gram, Groundnut, Soybean and Sugarcane.	5 L

Unit 2 Crop Families and Embryology: (10 L)

Classification of crops, Major crops belonging to the Dicotyledons and Monocotyledons families – Fabaceae (Papilionaceae), Brassicaceae, Solanaceae, Poaceae.	6L
Structure of anther, structure and development of male gametophyte.	2 L
Structure of ovule, Structure and development of female gametophyte.	2 L

Unit 3 Reproductive Biology: (10 L)

Structure of Dicotyledonous and Monocotyledonous flowers- Unisexual (Cucurbits and Maize) and Bisexual (Beans and Jowar)	3 L
Pollination, Autogamy, Allogamy.	2 L
Fertilization, Endosperm formation and Embryo.	2 L
Apomixis, Polyembryony.	2 L
Effect of environment factors on floral biology.	1 L

Unit- 4 Seed structure and Development: (10 L)

Seed structure, Development of embryo, endosperm fruit and seed.	3 L
Structure of Dicotyledon and Monocotyledon seeds, external and internal characters e.g. Cotton, Pea, Castor and Maize.	3 L

Seed ripening and maturation process.	1 L
Chemical composition of cereals, pulses and oil seeds with suitable examples.	2 L
Synthesis and storage of reserve food in seeds.	1 L

Total No of Lectures 40

Learning Outcomes

1. Student should learn about concept of seed technology.
2. Student should learn about seed identification based on morphological characters
3. Student should get knowledge about reproduction in plants, seed structure and development

References

Unit-I

1. Seed Technology- Agarwal R.N. Oxford and IBHJ Publication New Delhi.
2. Seed pathology, D.K. Jha, Vikas Publishing House pvt. Ltd.
3. Plant breeding Principles and Methodology –Sing B. D., Kalyani Publishers New Delhi.
4. Hand book of Agriculture ICAR, New Delhi.
5. Seed Production and field crops. Mondal, Saha, New India Publishers Agency, New Delhi.

Unit-II

1. Angiosperms-Chopra
2. A Text book of Botany Angiosperms- Singh, Pande, Jain-Rastogi publication New Delhi
3. An Introduction to Embryology of Angiosperms- Maheshwari P. Mc Graw hill book co. New York.
4. An Introduction to Embryology- Vol. I Parihar N.S.

Unit – III

1. An introduction to Embryology of Angiosperms- Maheshwari P. McGraw hill book co. New York
2. Embryology of Angiosperms- Bhojwani and Bhatnagar
3. Taxonomy of Angiosperms- Naik V.N. , Tata McGraw Hill, New Delhi

Unit-IV

1. Angiosperm, Embryology and Taxonomy -Johri B.M. Bull. Nat. Institute. Science, India 34:263-268
2. Physiology and Biochemistry of Seed Dormancy and germination- North Holland, Amsterdam.
3. Seed Science and Technology- Joshi and Singh. Kalyani Publishers New Delhi.

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SEED TECHNOLOGY (Theory)
Semester I Paper II
Plant Breeding

Unit 1 Concepts in Plant Breeding: (10 L)

Plant breeding: Introduction, History, Objectives and important achievements in crop improvement.

Plant breeding methods (Introduction and acclimatization, Selection, Mutation breeding, Polyploid breeding, Breeding for disease resistance).

Modes of pollination in crop plants- Self Pollination and Cross Pollination

Male Sterility: Definition, Types, Methods, Induction and Applications

Self Incompatibility: Definition, Types, Mechanisms, Methods, Induction and Applications.

Organizations of plant breeding in India.

Unit 2 Genetic basis of Plant Breeding, Plant Exploration and Plant Introduction: (10 L)

Genetic Basis of Crop improvement: brief account of Mendelian principles of inheritance, gene interactions, Gene and Environment, Inheritance of quantitative traits and cell division.

Plant Exploration: Centers of origin, Centers of genetic diversity

Seed Collection and Seed Banks: Introduction, Types of seed collection, Types of seed banks, Role of seed banks.

Plant Introduction and Acclimatization: Concept, Objectives, Types, Merits and Demerits.

Unit 3 Selection Methods of Plant Breeding: (10 L)

Selection: Concept, Procedure and Field Techniques, Merits and Demerits.

Mass Selection: Concept, Procedure and Field techniques, Merit, Demerits and Achievements

Pure-line Selection: Concept, Procedure and field techniques, merit, demerits and achievements.

Clonal Selection: Concept, procedure and field techniques, merit, demerits and achievements.

Unit 4 Hybridization Method of plant breeding:

(10 L)

Introduction, concept, objectives, merits, demerits.

Techniques of hybridization: Selection and evaluation of parents, emasculation bagging and tagging, pollination, collection and storage of F₁ seeds and growing of F₁ generation.

Hybridization in cross pollinating crops, development of inbred lines, effect of selfing, single cross and double cross hybrids, development of synthetic and composite varieties

Hybridization in self pollinated crops, concept of heterosis

Pedigree method, bulk method, back cross method, multiline varieties, F₁ hybrids.

Total No of Lectures 40

Learning Outcomes

1. Student should learn plant breeding and its various aspects.
2. Student should learn genetic basis of plant breeding and various methods of hybridization in plants.
3. Student should learn about resources of seeds along with centers of origin.

References

Unit –I

1. Principles and practices of plant breeding, Sharma J. R.
2. Plant breeding principles and methods Sing B.D. Kalyani publishing Ludhiana.
3. Elementary Basic of plant breeding –Chaudhari H. K.

Unit-II

1. Cytogenetics and Breeding. Chandrashekhar and Parthasart.
2. Plant breeding Principles and Methodology –Sing B. D., Kalyani Publishers New Delhi.

Unit – III

1. Elementary Basic of Breeding, Chaudhari H.K.
2. Plant Breeding- Chopra V. L.
3. Breeding Asian Field Crops Fehlman J. H. and Borthakur D. 1972 Oxford and IBH publishing company New Delhi.

Unit-IV

1. Elementary Basic of Breeding, Chaudhari H.K

2. Plant breeding principles and methods Sing B.D. Kalyani publishing Ludhiana.
3. Plant Breeding Theory and practice Chopra V. L. Oxford and IBH publishing company New Delhi.

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SEED TECHNOLOGY (Practical)

Practical Course I

Practicals Based on Theory Papers of Semester I

- | | |
|---|-----|
| 1. Study of family Fabaceae. | (1) |
| 2. Study of family Brassicaceae. | (1) |
| 3. Study of family Solanaceae. | (1) |
| 4. Study of family Poaceae. | (1) |
| 5. Morphology of Dicotyledon seeds: Castor and Groundnut. | (1) |
| 6. Morphology of Monocot seeds: Maize and Jowar. | (1) |
| 7. Seedling morphology of monocotyledon and dicotyledon crops. | (1) |
| 8. Adult plant morphology for the identification of any two varieties of the following crops – Soybean, Groundnut, Gram, Wheat. | (1) |
| 9. Study of tools and equipments required for plant breeding | (1) |
| 10. Demonstration of hybridization techniques in crops (any two suitable crops). | (2) |
| 11. Cytological techniques for the study of chromosomes- | (2) |
| i) Preparation and use of pretreatment solution of PDB/Colchicine/8HQ. | |
| ii) Fixatives and preservatives | |
| iii) Stains- Acetocarmine / Acetoorcein / Propino-carmine / Feulgen | |
| 12. Study of somatic chromosomes in root tips | |
| 13. Study of Mitosis. | (1) |
| 14. Study of Meiosis. | (1) |

Total No of Practical 15

Learning Outcomes

- 1- 4: Students should learn taxonomic account of major crop plants.
- 5-6: Students should learn morphology of dicotyledonous and monocotyledonous seeds.
- 7: Student should know seedling morphology of dicotyledonous and monocotyledonous plants.

- 8: Student should learn about identification of crop varieties based on morphological differences.
- 9-10: Students should learn tools and equipments in plant breeding along with demonstration of hybridization techniques.
- 11-14: Student should learn about different cytological techniques useful in plant breeding

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SEED TECHNOLOGY (Theory)
Semester II Paper III
Seed Physiology

Unit 1 Physiology of Seed Development: (10 L)

Factors affecting seed set, Seed ripening and maturation process.
Chemical composition of seed.
Synthesis of food reserves (carbohydrates, proteins and lipids).
Seed vigour, its measurement and crops productivity.

Unit 2 Seed Dormancy: (10 L)

Concept, types and causes of seed dormancy.
Methods of breaking seed dormancy.
Advantages and disadvantages of seed dormancy.
Seed viability, Seed longevity and specific problems of dormancy.
Seed storage: Introduction, types of seed storage, seed deterioration during storage and factors affecting it.
Methods to minimize seed aging and deterioration.

Unit 3 Seed Germination: (10 L)

Concept, types of seed germination and requirements for seed germination.
Pattern of water absorption.
Metabolism of storage product during seed germination.
Respiratory pathways during seed germination.
Seedling abnormalities and their causes.

Unit 4 Concept of Advanced Seed: (10 L)

Seed longevity behaviour: orthodox and recalcitrant seed
Seed pelleting and coating (Artificial or synthetic seed production)
Micropropagation: techniques, significance, use, scope and limitations.

Total No of Lectures 40

References

Unit -1

1. Seed physiology-Murray D. R., Academic Press. New York
2. Physiology and Biochemistry and Seed dormancy and Germination. Khan A.A. North Holland Amsterdam

Unit –II

1. Plant breeding Principles and Methodology –Sing B. D., Kalyani Publishers New Delhi.
2. Seed Science and Technology- Joshi, Sing Kalyani Publishers New Delhi.
3. Principles of Plant breeding. Allard R.W., John Millon and Sons Inc. New York.
4. Methods of breeding –Immer, H.K. and Smith, Mc Graw Hill. Book.co. International New York.

Unit –III

1. Plant breeding Principles and Methodology –Sing B. D., Kalyani Publishers New Delhi.
2. Seed Science and Technology- Joshi, Sing Kalyani Publishers New Delhi.

Unit –IV

6. Seed Technology- Agarwal R.N. Oxford and IBHJ Publication New Delhi.
7. Principles of Seed Science and Technology- Copuland and Mc Donald Burgess Publishing co. USA.
8. Tissue Culture-Rajdan

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Semester II Paper IV
Seed Production

Unit 1 Unit – 1 - Seed Quality Concept: (10 L)

Seed quality: Concept, role of high quality seeds in increasing crop production, seed quality control, characteristics of sowing quality seeds

Classification of crop plants in relation to mode of reproduction and choice of method for seed production

Choice of area of seed production. Factor affecting the choice of area of seed production – soil types, climate, nutrition, weed status, insect pests and disease incidence

Seed production organization in India: National Seed Corporation (NSC) and State Seed Corporation (SSC), Tarai Development Corporation (TDC) and their role in seed industry.

Unit 2 Hybrid Seed Production: (10 L)

Improvement of pollination in seed production of forage legumes and vegetables. Improvement of pollination in hybrid seed production.

Feasibility of hybrid seed production by use of hand emasculation, detasseling, male sterility, gametocides and self-incompatibility.

System of breeding and testing of crop varieties and hybrids in self and cross pollinated crops. System of release and notification of varieties for general cultivation

Unit 3 Genetic Purity of Varieties: (10 L)

Genetic purity of varieties: concept, factors responsible for their deterioration

Methods of maintenance of genetic purity.

System and methods of production of nucleus, breeder, foundation and certified seed.

Unit 4 Seed Production Procedures: (10 L)

Seed production procedure of following crops with special reference to requirement, isolation, agronomic management, rouging, harvesting and threshing

Sunflower and Groundnut

Mung and Soybean

Wheat, Jowar, and Maize

Brinjal and Tomato

References

Unit- I

1. Seed Science and Technology- Joshi, Sing Kalyani Publishers New Delhi
2. Plant breeding Principles and Methodology –Sing B. D., Kalyani Publishers New Delhi.
3. Seed Technology- Agarwal R.N. Oxford and IBHJ Publication New Delhi.

Unit-2.

1. Seed Technology- Agarwal R.N. Oxford and IBHJ Publication New Delhi.
2. Principles of Plant breeding. Allard R.W., John Millon and Sons Inc. New York.

Unit-III

1. Seed Science and Technology- Joshi, Sing Kalyani Publishers New Delhi.
2. Seed Technology- Agarwal R.N. Oxford and IBHJ Publication New Delhi.

Unit-IV

1. Seed Production and field crops. Mondal, Saha, New India Publishers Agency, New Delhi.
2. Seed Technology- Agarwal R.N. Oxford and IBHJ Publication New Delhi

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SEED TECHNOLOGY (Practical)

Practical Course II

Practicals Based on Theory Papers of Semester II

1. Phenol test (Wheat and Paddy) and NaOH test (Any seed); Peroxidase and GA tests. (2)
2. Study of seed germination (epigeal and hypogeal) in 3-4 suitable /available crops. (1)
3. Study of effects of environmental factors (Light and temperature) on seed germination. (1)
4. Study of seed viability with the biochemical tests. (1)
5. Study of Pollen sterility and fertility (any four crops). (1)
6. Seed pelleting and coating (artificial seed) (2)
7. Sterilization and Inoculation (1)
8. Preparation of culture medium (MS). (1)
9. Demonstration of micropropagation. (1)
10. Floral Biology of crop plants as per theory (any five crops) Sunflower, Maize, Bean, Wheat, Jowar and Groundnut. (2)
11. Field visits to different seed production farms /units, seed Production Company (At least two visits). (2)

Total No of Practical 15

