DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.SU/Sci./M.Sc./09/2019

It is hereby inform to all concerned that, as per recommendation of the Dean, Faulty of Science & Technology, the Hon'ble Vice-Chancellor **has accepted to include the Syllabus of "Seed Technology" as one of the Optional Subject for M.Sc.Botany second year at college level** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

This shall be effective from the Academic Year 2019-20 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO. SU/SCI/2019/ 8275-83
Date:- 09-09-2019.

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Deputy Registrar,
Syllabus Section.

Copy forwarded with compliments to :-

1] **The Principals, affiliated concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation,
2] The Section Officer,[M.Sc.Unit] Examination Branch,
3] The Programmer [Computer Unit-1] Examinations,
4] The Programmer [Computer Unit-2] Examinations,
5] The In-charge, [E-Suvidha Kendra],
Rajarshi Shahu Maharaj Pariksha Bhavan,
6] The Public Relation Officer,
7] The Record Keeper.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Curriculum under CBC&GS

M.Sc. Botany

Semester IIIrd & IVth

(Optional Subject)

Seed Technology.

UNDER THE FACULTY OF SCIENCE & TECHNOLOGY.

[Effective from 2019-20 & onwards]

M.Sc. Botany (Optional) Seed Technology Syllabus (Sem III & IV)

M. Sc. Botany
(Optional Subject)
Course Structure of " Seed Technology"

Semester- III & IV

Sr. No.	Course No.	Title of the Course	Hrs	Credits Allotted	Theory				Practical	
					INTERNAL	EXTERNAL	(MAXIMUM)	MINIMUM	MAXIMUM	MINIMUM
Semester III										
13	BOT 521 E	**Seed Technology -I**	07	3T+ 2 P	20	80	100	40	50	20
14	BOT 522E	**Seed Technology -II**	07	3T+ 2 P	20	80	100	40	50	20
15		Project Work	03	3T	--	--	--	--	--	--
16	Service Course	Plant Tissue Culture	04	4T	--	--	100	40	--	--
		Total		**29 Credits**						
Semester IV										
20	BOT 523E	**Seed Technology -III**	07	3T+ 2 P	20	80	100	40	50	20
21	BOT 524E	**Seed Technology -IV**	07	3T+ 2 PEach	20	80	100	40	50	20
		Project Work	07	7T	--	--	--	--	50	20
		Total		**29 Credits**						

Preamble:

Seed Technology is a Specialization and one of the optional Course approved by Dr. BabasahebAmbedkarMarathwada University, Aurangabad for M.Sc. (Botany)Semester- III and IV (Optional Subject). This curriculum is under Credit Based Grading System, It is offered as one of the subjects among the other four Optional subjects at the M.Sc.(Botany) Semester- III and IVlevel.This Course Includes Two theory (Paper I and Paper II) and two practical (Related to Paper I and II on basis of Theory) course for Semester III and Two theory (Paper III and Paper IV) and two practical (Related to Paper III and IV on basis of Theory) course for Semester IV, compulsory coursesare offered at the M.Sc. (Botany)level. The course is coordinated and conducted by the Department of Botany

M.Sc. Botany (Optional) Seed Technology Syllabus (Sem III & IV)

Introduction:

Seed Technology is a science dealing with the methods of improving genetic and physical characteristics of seed. Study of seed technology is necessary for two reasons.Firstly, the introduction of hybrids and high yielding varieties of crop plants of immenseimportance has necessitated great care in the maintenance and preservation of seed.Secondly, if seed production is to evolve as a prime enterprise, instead of a byproduct asit has been characteristically handled down through the centuries. Development of seedenterprise is absolutely necessary in the context of modern agriculture. It is the quickestway of increasing agricultural production. Much of our success in increasing foodproduction has been due to the development of seed enterprise over the past decade.

Seed demand at present is strong and expected to continue expanding.Indian economy depends on agriculture and about 60 % of Indian populationdepends on agriculture. For quality production the farmers need quality seeds orpropagating materials. Unless the farmer gets seeds, which are genetically pure andpossess other desired qualities namely, high germination percentage and vigour, high purity, sound health etc. he cannot obtain the expected yields.

The quality material is provided to the farmers by the seed industries establishedthroughout the country. These industries are in continuous demand for theknowledgeable, trained, talented Seed Technologists. These industries provide Career opportunities to post graduate students in the following ways:

- Management of seed enterprise (Govt./Semi govt. undertakings and private seedcompanies)
- State and Central Seed Testing Laboratories
- Seed certification agencies
- Seed law enforcement agencies
- Training/Extension centers
- Research institutes

The course focuses on training students in plant breeding, tissue culture, seed health testing techniques, testing for purity of seeds, crop improvement, protection and storagetechniques.

Importance of Seed technology: The prime importance of this course is due to –

- Seed is a carrier of new technologies
- Seed is a basic tool for secured food supply
- Seed is the principal means to secure crop yields in less favorable production areas
- Seed is a medium for rapid rehabilitation of agriculture in cases of naturaldisaster.

The proposed syllabus lays more stress on practicals as compared to theory. It willconcentrate on experimental practice and theoretical aspects. This approach justifies theterm 'Professional and vocational'. The teaching center at the college will develop trained manpower for the industriesand employments will be generated. Students can also become entrepreneurs. Trainedand competent teachers with experience in industry would be ideal to teach the subject. Besides such teachers, persons from industry could contribute to the course.

Objectives to be achieve:

- To promote the possibility of self-employment after M.Sc.Botany (SeedTechnology).
- To Bridge up the gap between knowledge based conventional education and market demands and to provide an alternative to those pursuing higher education.
- To enrich students' training and knowledge that would be useful in the seed industry so that the farmers will get quality seeds.
- To introduce the concepts of experimental design in Seed Technology.
- To inculcate sense of job responsibilities, while maintaining social and environment awareness.
- To help student's build-up a progressive and successful career in industries with a biotechnological perspective.

M.Sc. Botany (Optional) Seed Technology Syllabus (Sem III & IV)

Eligibility:

1. First Year M.Sc. Botany : B.Sc. with Botany is the one of the subject or B.Sc.(Agri) or its equivalent Examination with English or Crop Science or Crop Production or Horticulture.
2. Admissions will be given as per the selection procedure / policies adopted by the respective college keeping in accordance with conditions laid down by the Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
3. Reservation and relaxation will be as per the State Government rules.

Standard of Passing

As per the guideline of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad and UGC New Delhi (Please See the Course structure).

M.Sc. Botany (Optional) Seed Technology Syllabus (Sem III & IV)

BOT-521- (Elective-E)

Seed Technology-I

(Seed Morphology, development and Germination)

(Theory, Semester III)

Objectives:

(1) To refresh the basic knowledge of seed development and structures and apprise students with its relevance to production of quality seed.

(2) To get familiarized with structure and functions of kinds of monocotyledons and dicotyledons seeds.

Unit I. Double fertilization in Angiosperms: Definition, process of fertilization in angiosperms, Development of Dicotyledons and Monocotyledons Embryo, types of endosperms and functions of endosperms. **Seed:** Definition, difference between seed and grain, concept of seed quality (inner core, middle core, outer core)

Unit II. Seed Development, Seed Morphology and Seed Physiology: Seed development, Sporogenesis, Fertilization, Embryogenesis and Seed Formation, type of embryo, endosperm and cotyledons, Parthenogenesis, Parthenocarphy, Apomixes. Seed coat structure, significations mechanical strength and permeability, Seed maturation. Harvest maturity, Influence of season, climate, nutrition's and other cultural management practices on development and maturation of seeds, occurrence of hard seed and seed dormancy etc.

Unit III. Apomixes – Identification, classification, significance and its utilization in different crops for hybrid seed production; Polyembryony - types and significance; haplontic and diplontic sterility, causes of embryo abortion, embryo rescue and synthetic seeds.

Unit IV. Seed Germination and Vigour: Seed germination requirements in Agriculture and Horticulture crop seed. Factors affecting seed germination and role of the different type of seed in germination. Biochemical changes during germination. Role of promoters and inhibitors in seed germination. Effect of age, size and position of seed on germination. Seed vigour and its concept, factor affecting seed vigour, physiological and genetical basis of seed vigour, vigour test, seed vigour and crop performance and yield.

Unit V. Seed dormancy - types, mechanism, endogenous and exogenous factors affecting on seed dormancy and methods to break it. Chemical compositions and structural architecture of the bio -membranes and its impact on seed germination and viability.

Unit V. Seed as a basic input in agriculture, seed development in cultivated plants; classification of crop plants in relation to mode of reproduction; seed production in self- and cross-pollinated crops.

Unit VI. Genetic Purity and its Maintenance: Definition, concept and importance of genetic purity in seed production; Steps for maintenance of genetic purity- checking seed sources, isolation distance, Rouging, Precaution during crossing Program, Care during harvesting and threshing.

References:

1) Bhojwani, S.S. and Bhatnagar, S.P. 1999. The Embryology of Angiosperm. Vikas Publ.
2) Black, M., Bewley, D. and Halmer, P. 2006. The Encyclopedia of Seeds: Science, Technology and Uses. CABI.
3) Chhabra, A.K. 2006. Practical Manual of Floral Biology of Crop Plants. Deptt. of Plant Breeding, CCS HAU, Hisar.
4) Copeland, L.O. and McDonald, M.B. 2001. Principles of Seed Science and Technology. 4th Ed. Chapman & Hall.
5) Frankel, R. and Galun, E. 1977. Pollination Mechanisms, Reproduction and Plant Breeding. Springer Verlag

6) Bench, A.L.R. and Sanchez, R.A. 2004. Handbook of Seed Physiology. Food Product Press.
7) Black, M. and Bewley JD. (Eds.). 2000. Seed Technology and its Biological Basis. Sheffield Academic Press.
8) Nicolas, G., Bradford, K.J., Come, D. and Pritchard, H.W. 2003. The Biology of Seeds, Recent Research Advances. CABI.

Practical on the basis of
BOT-521- (Elective-E)
Seed Technology-I

(Seed Morphology, development and Germination)

(Practical, Semester III)

Practical:

1) Study of floral biology of monocots and dicots; micro-sporogenesis and mega-sporogenesis;
2) Study of Pollen morphology. Monocot and dicot embryos
3) Studies on floral morphology of some important field crop plants
4) Study of pollen grains - pollen morphology, pollen germination and pollen sterility;
5) Study of types monocot and dicot embryos;
6) Study of external and internal structures of monocot and dicot seeds; seed coat structure, preparation of seed albums and identification.
7) Study different types of dormancy in seeds.
8) Study of different methods of breaking seed dormancy.
9) Study of seed production practices in relation to weed control, harvesting and threshing in Cotton/ bajra/sorghum/tomato/ brinjal etc.
10) Visit to Seed Industry/Plant breeding Research Centre. Visit is compulsory for the students. They are suppose to write a visit / Study report and submit it at the time of final practical examination.
11) To Student are supposed to submit seed samples (minimum 15) along with their botanical names, family, variety etc to the department at the time of final practical Examination.
12) Study the Field inspection at various stages.

BOT-522- (Elective-E)
Seed Technology-II
(Seed Quality Control, Act and Regulation)

(Theory, Semester III)

Objectives:

1. To learn about the concepts and significance of seed quality control.
2. To know about various aspects related to seed certification and seed legislation.
3. To have the knowledge of national and international seed quality control organizations and seed certification agencies.

Unit I: Seed and Quality Control: Concept of seed quality control, Field inspection & its methods, Classes of seed, Importance of good quality seeds. Seed quality standards - definition and concept, Role of "Quality Control" for import and export of seeds.

Unit II: Seed Sampling and kinds of Testing-Definition, General principles of Seed sampling, Procedure and methods (Paper, Sand and Soil), heterogeneity test, kinds of Sample and procedure of seed sampling, its receipt and registration. **Physical purity analysis**-Definition of purity components, Procedure, ODV test, Reporting and results. Determination of other

seeds by number and other distinguishable for different crops, seedling evaluation. **Moisture Testing** (1) By air oven method, (2) Moisture meters. **Tetrazolium test** - principles, procedure and evaluation. Testing for coated / pelleted seeds. Testing for varietal verification, grow-out test, Seed health, **Seed Vigour testing-** Principle, General procedure. Insect damage, reporting of seed testing results, factors affecting variability, use of tolerance tables in seed testing, Sequential sampling analysis, Weed seed identification, preservation and storage of samples.

Unit.III. Seed Certification: Objectives, Concept, purpose and phases of seed certification, Certification agency. Variety eligibility, classes and sources of seed, verification of seed sources. Unit of certification, isolation distance, comparing field observations with minimum standards, tolerance levels. Seed analyst and his duties. Laboratory evaluation and packaging, seed lot size and construction of seed lot numbers, certified seed level, certification tag, validity period of certification, Seed control order, Seed policy. General seed certification standards, Specific crop standards.

Unit.IV. Seed Testing Rule and regulatory system in seed quality control:: National and International seed testing rules, Seed testing organizations, International seed testing Association (ISTA), Association of Official seed Analysts, Statutory bodies and agencies established in India- (a) Central seed committee, (b) Central seed certification board, (c) Central seed testing laboratory, (d) State seed certification agency, (e) State seed testing laboratory, (f) Appellate authority, (g) Committee for recognition of seed certification agencies of foreign countries.

Unit V: Regulatory mechanisms of seed quality control- organizations involved in seed quality control programmes; seed legislation and seed law enforcement as a mechanism of seed quality control; the Seed Act (1966), Seed Rules (1968), Seed (Control) Order 1983; Essential Commodities Act (1955); Plants, Fruits and Seeds Order (1989); National Seed Development Policy (1988) and EXIM Policy regarding seeds, plant materials; New Seed Bill-2004 etc. Introduction, objectives and relevance of plant quarantine, regulations and plant quarantine set up in India.

Unit V. Seed law enforcement: Introduction, Duties of seed inspector, Powers of seed inspector, field inspection and reporting of results, Offenses and penalties, Procedure of seed law enforcement, inspection procedures and equipment required.

References:

1) Agarwal, R.L. 1997. Seed Technology. 2nd Ed. Oxford & IBH.
2) Chhabra, A.K. 2006. Practical Manual of Floral Biology of Crop Plants. Dept. of Plant Breeding CCS HAU, Hisar.
3) Desai, B.B. 2004. Seeds Handbook. Marcel Dekker.
4) Kelly, A.F. 1988. Seed Production of Agricultural Crops. Longman.
5) Mc Donald, M.B. Jr and Copeland, L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall.
6) Musil, A.F. 1967. Identification of Crop and Weed Seeds. Handbook No. 219, USDA, Washington, DC, USA.
7) Poehlman, J.M. and Sleper, D.A. 2006. Breeding Field Crops. Blackwell.
8) Singh, B.D. 2005. Plant Breeding: Principles and Methods. Kalyani Publishers.
9) Singhal, N.C. 2003. Hybrid Seed Production in Field Crops. Kalyani Publishers.
10) Thompson, J.R. 1979. An Introduction to Seed Technology. Leonard Hill.
11) Tunwar, N.S. and Singh, S.V. 1985. Handbook of Cultivars. CSCB, GOI.

M.Sc. Botany (Optional) Seed Technology Syllabus (Sem III & IV)

BOT-522- (Elective-E)
Seed Technology-II
(Seed Quality Control, Act and Regulation)

(Practical, Semester III)

Practical:

1. Study of seed Sampling and Dividing Equipments.
2. Study of germination Testing (Paper, Sand and Soil Method).
3. Study of Seed vigour testing by physical method.
4. Study of ODV test and Physical purity analysis.
5. Study of the quick viability (Tetrazolium test) of seeds, germination test and its analysis,
6. To Grow out test, Accelerated aging test, activity of enzymes, respiratory rates etc
7. Study of draw the sampling entry in records, dividing and mixing.
8. Study of testing physical purity, germination and moisture;
9. Determination of weight of seed samples
10. Study of Moisture testing by oven method and moisture meter.
11. Compulsory visit to Seed Testing Laboratory.
12. Make a draft for seed certification agency (As per Indian Seed regulation Act) of a given seed sample.
13. Study of General procedure of seed certification, identification of weed and other crop seeds as per specific crops seed testing regulation.
14. Study of field inspection at different stages of a crop and observations recorded on contaminants and reporting of results.
15. Study of inspection and sampling at harvesting / threshing, processing and after processing for seed law enforcement;
16. Study of specifications for tags and labels to be used for certification purpose; grow-out tests for pre and post-harvest quality control.
17. Visits to regulatory seed testing laboratory, including plant quarantine lab and seed certification agency.

References:

1) Agarwal, R.L. 1997. Seed Technology. Oxford & IBH.
2) Anonymous. 1992. Legislation on Seeds. NSC Ltd., Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi.
3) Nema, N.P. 1986. Principles of Seed Certification and Testing. Allied Publishers.
4) Tunwar, N.S. and Singh, S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
5) Handbook of Agriculture- Indian Council of Agricultural Research, New Delhi
6) Umarani*et. al.*2006. Experimental Seed Science and Technology, Agrobios,Jodhpur
7) Singh, 2009. Plant Breeding: Principles and Methods. Kalyani Publishers, NewDelhi
8) Agrawal, 2005. Seed Technology. Oxford and IBH Publishing Co. Pvt. Ltd., NewDelhi
9) Reddy, 2008. Principles of crop production. Kalyani Publishers, New Delhi
10) Pandey, 2010. A text book of Botany. S. Chand and Company Ltd., New Delhi
11) Santra and Chatterjee, 2007. College Botany, New Central Book Agency (P) Ltd.,Kolkata
12) Dutta, 1983. A Class book of Botany, Oxford University Press, Calcutta

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M.Sc. Botany (Optional) Seed Technology Syllabus (Sem III & IV)

BOT-523- (Elective-E)
Seed Technology-III
(Hybrid Seed Production)

(Theory, Semester IV)

Objectives:

1. To provide a comprehensive knowledge and practical exposure to hybrid seed production in field crops and vegetables.
2. To learn various conventional and non-conventional Hybrid Seed Production technologies.
3. To learn the principles and need for the production of hybrid seeds particularly in field crops.

Unit I: Basic principles of hybrid seed production: Definition, Pre requisites for hybrid seed production; mechanisms and management of pollination in autogamous and allogamous crops; genetic constitution of varieties, hybrids and basic principles in seed production. Selection of site for seed production, Sowing, row spacing, fertilizer and irrigation, Isolation, planting ratio and seed rate, Roguing and pollen shedders. **Population Improvement:** Introduction, Objectives and methods- Mass Selection, Progeny Selection, application and achievements.

Unit II: Techniques of hybrid seed production - Manual Emasculation and hand / insect pollination and crossing, use of self-incompatibility, modification of sex; types of male sterility and exploitation in hybrid development and its use in hybrid seed production; development and maintenance of A, B and R lines. Use of genetic male sterility, use of Gametocides.

Unit III: Heterosis and inbreeding depression- Definition, Genetic basis of Heterosis, Genetic basis of inbreeding depression, Commercial utilization

(i) Apomixes: Definition, Types of apomixes, Significance.

(ii) Male sterility: Definition, types of male sterility, GMS – Introduction and its use in hybrid seed production, CMS- Introduction and its use in hybrid seed production, C-GMS- Introduction, seed production of A,B and R-Lines.

(iii) Self- incompatibility – Definition, Kinds and utilization.

Unit IV. Seed Production: Seed as a basic input in Agriculture, Classes of Seeds- Nucleus, Breeder, Foundation and Certified Seeds. Seed production Organization- National Seed Corporation (NSC) and State seed Corporation (SSC).

Unit V. Release of New Variety: Introduction, Evaluation-Station Trial, Multi-location Trial, Disease and insect Tests, Identification of entries for release, Multiplication.

Unit VI: Hybrid seed production of-(1) Maize,(2) Bajra,(3) Jowar, (4) Cotton,(5) Sunflower,(6) Wheat with respect to –(I) Source of seed, (ii) Selection of field (Land requirement), (iii) Isolation, (iv) Sowing, (v) Cultural practices (Fertigation, Irrigation, plant protection), (vi) Roguing, (vii) Harvesting and threshing.

Unit. VII: Techniques Used in Hybridization- Crops & Vegetable: General Introduction of Plant breeding, Objectives and types, Procedure, Methods in plant Breeding –Introduction, Selection, Pure line selection, Pedigree selection, Mass Selection, Clonal Selection, Bulk method, role of Hybridization and Mutation in crop improvement.

References:

1) McDonald, M.B. and Copeland, L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall.
2) Basra, A.S. 2000. Heterosis and Hybrid Seed Production in Agricultural Crops. Food Product Press.
3) Singhal, N.C. 2003. Hybrid Seed Production. Kalyani Publishers
4) Handbook of Agriculture- Indian Council of Agricultural Research, New Delhi
5) Umarani*et. al.*2006. Experimental Seed Science and Technology, Agrobios, Jodhpur

6) Singh, 2009. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi
7) Agrawal, 2005. Seed Technology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
8) Reddy, 2008. Principles of crop production. Kalyani Publishers, New Delhi
9) Pandey, 2010. A text book of Botany. S. Chand and Company Ltd., New Delhi
10) Santra and Chatterjee, 2007. College Botany, New Central Book Agency (P) Ltd., Kolkata
11) Dutta, 1983. A Class book of Botany, Oxford University Press, Calcutta

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BOT-523- (Elective-E)
Seed Technology-III
(Hybrid Seed Production)

(Practical, Semester IV)

PRACTICAL:

1) Study of the methods of hybrid seed production in major agricultural and horticultural crops;
2) Study of prepare rows / blocks for parental lines and manipulations for achieving flowering synchrony for production of hybrid seeds,
3) Study of maintenance of A, B and R lines and production of breeder seed;
4) Study of the stable diagnostic characteristics of parental lines and their hybrids,
5) Study of calculate and determination the cost of hybrid seed production of some crops;
6) Visit to seed production plots and make a detail report of it.
7) Field visit for procure the knowledge of some terminology used in Hybrid technology-isolation-requirement for a crop, Rouging, harvesting and threshing,
8) Field visit for inculcate the knowledge for Nucleus, breeder, foundation and certified seed production in crops like wheat, maize, sorghum, pearl millet, chickpea, cowpea, pea, soybean, groundnut, mustard, sunflower, linseed, cotton, Tur.
9) Procure the knowledge of techniques viz.-Hand emasculation and pollination for hybrid seed production.
10) Study of knowledge of Nursery requirement, management of different vegetables and flower crops. Seedling age for transplanting. Floral structure and seed identification.
11) Study of the Emasculation and pollination studies in Maize and Cotton. 1p
12) Study on protogynous and protandrous nature of Pearl millet and sunflower. 1p
13) Identification of genetic male sterile plants at bud initiation stage and Laboratory method for
14) Study of the confirmation of sterility in maize by aceto-carmine test under microscope. 1p
15) Visit to seed processing plant. Operation and handling of mechanical drying equipments, Seed processing equipments, Seed treating equipments, Seed extraction, Seed quality up gradation, Seed blending.
16) Study of effect of temperature, moisture and length of storage on seed viability. Accelerated aging test and Visit to processing and storage plants.

References:

1) Agarwal, R.L. 1997. Seed Technology. Oxford & IBH.
2) Agrawal, P.K. and Dadlani, M. 1992. Techniques in Seed Science and Technology. 2nd Ed. South Asian Publ.
3) Agrawal, P.K. (Ed.). 1993. Handbook of Seed Testing. Ministry of Agriculture, GOI, New Delhi.
4) Copland, L.O. and McDonald, M.B. 1996. Principles of Seed Science and Technology. Kluwer.
5) ISTA. 2006. Seed Testing Manual. ISTA, Switzerland.
6) Martin, C. and Barkley, D. 1961. Seed Identification Manual. Oxford & IBH.

7) Tunwar, N.S. and Singh, S.V. 1988. Indian Minimum Seed Certification Standards. Central Seed Certification Board, Ministry of Agriculture, New Delhi.

BOT-524- (Elective-E)
Seed Technology-IV
(Seed Pathology, Seed Storage and Deterioration)
(Theory, Semester IV)

Objectives:

1. To apprise about the role of insects in seed production and their effect on seed quality during storage.
2. To procure the knowledge of Seed borne and storage fungi, bacteria, other micro organism and Pests.
3. To enculcate the knowledge of inspect the fields in respect to Insect pest, plant pathogen and their control measure.

Unit I: Seed Pathology: Introduction, History and economic importance of the seed pathology in seed industry, plant quarantine and SPS under WTO. Morphology and anatomy of typical monocotyledonous and dicotyledonous infected seeds.

Unit II: Seed Borne and Storage Fungi, Bacteria and Viruses: Definition of seed borne and storage fungi, Bacteria and Viruses, Differences between seed borne and storage fungi, Mechanism of seed transmission and entry point of seed infection,Common seed borne fungi (Any two) with examples, Common storage fungi (Any two) with examples. Impact of seed borne bacteria and viruses on seeds or crop with suitable examples(any two).

Unit III: Seed Entomology and management: Definition, Principles of seed entomology, Relation of insects and plants, Insects as vector; pollinator insects, insect pests and their classification based on mode of infestation etc. Classification of insect pest: Epidoptera, Diptera, Hemiptera, Isoptera, Coleoptera. Major insect pests management practices. Methods of insect pest control. Classes of pesticides, their handling and safe use on seed crops.

Unit IV: Life span of seeds of plant species: classification of seeds on the basis of storage behaviour; orthodox and recalcitrant seeds; types of storage; kinds of seed storage (open, bulk, controlled, hermetic, germplasm, cryopreservation); soil seed bank; survival curve of seed.

Unit V: Factors affecting seed storability: biotic and abiotic and pre- and post harvest factors affecting seed longevity; the effects of packaging materials, storage fungi and insects, seed treatment and fumigation and storage environmental conditions on seed storability; moisture equilibrium in seeds; hysteresis effect; thumb rules; selection of suitable areas for safe storage; prediction of relative storability and longevity of seed lots, viability equations and monographs.

Unit VI: Concept of seed ageing and deterioration, its causes, symptoms, mechanisms and related theories; different changes associated with the loss of vigour and viability during storage; application of physiological and biochemical techniques for evaluation of seed ageing; genetics of seed viability; effect of seed ageing on crop performance; maintenance of viability and vigour during storage; seed amelioration techniques, mid storage corrections etc.

Unit VII: Storage methods- requirement of storage facilities in India; types and storage structures available in the country and their impact on short and long term storage; methods of safe seed storage including eco-friendly techniques used in various group of crops viz. cereals, pulses, oilseeds, fibers, forages and vegetables; operation and management of seed stores; fruit storage; viability loss during transportation and interim storage. Management of seed storage structures

M.Sc. Botany (Optional) Seed Technology Syllabus (Sem III & IV)

References:

1) Agarwal, V.K. and Sinclair, J.B. 1997. Principles of Seed Pathology. Boca Raton.
2) Barton, L.V. 1961. Seed Preservation and Longevity. Burgess Publ.
3) Basra, A.S. (Ed.). 1995. Seed Quality: Basic Mechanisms and Agricultural Implications. Food Products Press.
4) Basra, A.S. 2006. Handbook of Seed Science and Technology. Food Product Press.
5) Desai, B.B. 2007. Seed Handbook: Biology, Production, Processing and Storage. Marcel Dekker.
6) Doijode, S.D. 2001. Seed Storage of Horticultural Crops. CBS.
7) Justice, O.L. and Bass, L.N. 1978. Principles and Practices of Seed Storage. Castle House Publ.
8) Kharb, R.P.S. and Kharb, P. 1977. Biochemical and cytogenetical changes during storage. In: Seed Technology (Eds. BS Dahiya & KN Rai): pp. 160-168.
9) Roberts, E.H. 1972. Viability of Seeds. Chapman & Hall.
10) Karuna, V. 2007. Seed Health Testing. Kalyani.
11) Neergaard, P. 1988. Seed Pathology. Mac Millan.

BOT-524- (Elective-E)
Seed Technology-IV
(Seed Pathology, Seed Storage and Deterioration)
(Practical, Semester IV)

PRACTICAL:

1) Study of Conventional and advance technique in the detection and identification of seed – borne fungi, bacteria and viruses.
2) Study of relationship between seed borne infection and expression of the disease in the field.
3) Study of symptoms and identification of important seed borne pathogens (Fungi).
4) Study of Visual examination of dry seeds for disease symptoms.
5) Study of Examination of suspensions obtained from washing of seeds.
6) Study of any two important storage grain pest with respect to their life cycle, way of Infestation /damage, symptoms and control measures.
7) Detection of important seed borne fungi with the help of various detection methods (Agarand blotter paper method).
8) Detection of important seed borne bacteria with the help of various detection methods.
9) Study of Techniques of seed health testing - visual examination of seeds, washing test, incubation methods, embryo count method, seed soak method for the detection of certain seed born pathogens.
10) Study of different methods of seed treatment.
11) Study of identification and collection of important storage grain pest.
12) Study of knowledge about the fumigation and various type of tools for dusting and spraying insecticides in Storage were house.
13) Study of storage structure and damage material.

M.Sc. Botany (Optional) Seed Technology Syllabus (Sem III & IV)

Suggested for further Readings:

1) Anonmyous, Hand Book of Agriculture, ICAR, New Delhi
2) Krishnasamy*et al*., 2004. Compendium on Seed Science and Technology, T. N.,Agricultural University, Coimbatore
3) Srivastava K. P., 2009., A Text Book of Applied Entomology, Kalyani Publishers, Ludhiana
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5) Aneja K. R. 2009. Experiments in microbiology, plant pathology and biotechnology, New
6) Age International (P) Limited Publishers.
7) Anonmyous. 1997. Seed Technology in Tropics. ISTA Zurich.
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10) Centre for Agrl. Publishing and Documentation, Washington.
11) Desai. B.B., P.M Kotecha and D.K. Salunkha. 1997. Seeds Hand Book - Biology
12) Production, Processing and Storage. Marcel Dekker. New York.
13) Kozlowski, T.T. 1972. Seed Biology, Vol. 1 Academic Press, London.
14) Justice, O.L. and L.N. Basu. 1978. Principles and Practices of Seed Storage. Castle House, Publications Ltd, Great Britain.
15) Copeland, L .O and McDonald. 1995 . Principles of Seed Science and Technology, Chapman and Hall, New York, USA.
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17) Seed Testing Association , Zurich , Switzerland .
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19) McDonald , M.B. and L.O. Copland . 1999. Seed Science and Technology Laboratory Manual. Scientific Publishers, Jodhpur ,
20) K.Vanangamudi , N. Natarajan , A, Bhatathi , R. Umarani and T. Saravanan . Advances in Seed Science and Technology ,Vol I .
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