

SHRI GURU RAM RAI UNIVERSITY

PATEL NAGAR DEHRADUN, UTTARAKHAND (INDIA)

(Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017)

COURSE CURRICULA & SYLLABI

Effective from Academic Session 2021-22

For Academic Programme

Ph. D. Seed Science and Technology



Approved By:

BOARD OF STUDIES, SEED SCIENCE AND TECHNOLOGY

**DEPARTMENT OF SEED SCIENCE AND TECHNOLOGY
SCHOOL OF AGRICULTURAL SCIENCES
SHRI GURU RAM RAI UNIVERSITY PATEL NAGAR DEHRADUN,
UTTARAKHAND (INDIA) -248001**

PRE-Ph.D. COURSE

(SEED SCIENCE & TECHNOLOGY)

Table: The course structure and Assessment scheme:

S. No.	Course code	Subject	Credits (L:T:P)	Total credit	Total marks	Minimum marks for completion
Core Courses						
1.	PAST-700	Advances in Seed Science and Research	4 (2:1:1)	4	80	40
2.	PAST-701	Doctoral Seminar- I	2 (0:0:2)	4	80	40
		Doctoral Seminar- II				
		Field work/workshop	2 (0:2:0)			
Basic Supporting Courses						
3.	PRMC-101	Research Methodology	4 (2:1:1)	4	80	40
4.	PREC-102	Research & Publication Ethics	2 (1:1:0)	2	40	20
Elective Courses*						
5.	PAST-603	Seed Laws and DUS Testing for Plant Variety Protection	4 (2:1:1)	4	80	40
	PAST-604	Hybrid Seed Production	4 (2:1:1)			
	PAST-605	Testing for Genuineness and Purity of Cultivars	4 (2:1:1)			
	PAST-606	Emerging Trends in Seed Quality Enhancement	4 (2:1:1)			
Total				18	360	-
Ph. D. Thesis Research**						
6.	PAST- 702	Ph. D. Thesis Research		45	Non gradial	

*Elective courses (Students have to select any *one* course from above elective courses)

**After completion of pre-Ph.D. course work, student has to register for Ph.D. Seed Science and Technology. He/she will have to fill up a prescribed admission form of university and submit along with the synopsis on a proposed research work under the designated supervisor of the university.

Pre Ph.D. Course Syllabus

SEED SCIENCE AND TECHNOLOGY

Course code: PRMC-101

Course name: Research Methodology

Credits: 4 (2:1:1)

Objective

To apprise students with the knowledge of statistical methods and techniques, and their application in seed science and technology.

Theory

Unit I

Concept & Types of Research

Meaning and importance of Research – Types of Research – Selection and formulation of Research Problem – Research Design, Classification of Research, Pure and Applied Research, Exploring or Formulative Research, Descriptive Research, Diagnostic Research/Study, Evaluation research/Studies, Action Research, Experimental Research, Analytical Study of Statistical Method, Historical Research,

Unit II

Methods Research

Surveys, Case Study, Field Studies General Survey of various Methods including Survey Method, Interdisciplinary Method, Cash Study Method, Sampling Method, Statistical Method, Observation Method, Interview Method, Schedule Method, Questionnaire Method, Documentary Method, Library Method, Historical Method and Scientific Method. Characteristic Features of Scientific Method; Empirical Verifiable, Cumulative, Self - Correcting, Deterministic, Ethical & Ideological neutrality (Value Free).

Unit III

Data Collection and Data Analysis

Collection, objectives and classification of data, aims, methods and objects of tabulation of data, forms and processes of interpretation and presentation of data.

Primary, secondary and tertiary data, Construction and adaptation of instruments, administration of questions and tests, tabulation of data. Data organization in spss & excel, graphical representation of data.

Definition and Aims of Content Analysis, Problems of Content Analysis, Computer and Content Analysis Discussion and Interpretation of results, Testing of Hypothesis: Logical and Statistical Techniques.

Unit IV

Report Writing

Locating Information on a Topic of Interest, Acquiring Copies of Articles of Interest, The Nature of Scientific Variables, Conceptual Versus Operational Definitions of Variables, Levels of Measurement, Various Paradigms including Formism, Mechanism, Organicism, Pragmatism, The Basic Format for a Research Report, Identification of the Parts of a Research Report, Citation and Referencing Styles, Essentials of Report Writing, Aids for Writing Good Research Report.

References

- Bagchi, Kanak Kanti (2007). Research Methodology in Social Sciences: A Practical Guide, Delhi, Abijeet Publications.
- Sharma, B.A.V. et al., (2000). Research Methods in Social Sciences, New Delhi, Sterling Publishers.
- B.A.V. Busha, C. H and Harter, S. D. (1980). Research Methods in Librarianship, New Academic Press.
- Cooper, R. Donald and Pamela S. Schindler (2003). Business Research Methods, Delhi, Tata McGraw-Hill.
- Flyvbjerg, Bent (2001). Making Social Science Matter: Why Social Inquiry Fails and How it can succeed Again, United Kingdom, Cambridge University Press.
- Goodde and Hatte (1952). Methods in Social Research, New York, Mc Graw – Hill.
- Gopal, M.H (1970) An Introduction to Research Procedures in Social Sciences, Bombay, Asia Publishing House.
- Hunt, Morton (1989) Profiles of Social Research: The Scientific Study of Human Interactions, Bombay, Popular Prakashan.
- Kothari, C.R (2004) Research Methodology: An Introduction, Delhi, New Age.

Course code: PREC-102

Course name: Research & Publication Ethics

Credits: 2 (1:1:0)

Objective

To provide ethical knowledge and values related to agricultural research

Theory

UNIT I

Philosophy and Ethics

Introduction to Philosophy: definition, nature and scope, concept, branches Ethics: definition, moral philosophy, nature of moral judgments and reactions

UNIT II

Scientific Conduct

Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)

- Redundant publications: duplicate and overlapping publications, salami slicing
- Selective reporting and misrepresentation of data

UNIT III

Publication Ethics

- Publication ethics: definition, introduction and importance
- Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
- Conflicts of interest
- Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice -versa, types
- Violation of publication ethics, authorship and contributorship
- Identification of publication misconduct, complaints and appeals
- Predatory publishers and journals

Practicals

Open Access Publishing

- Open access publications and initiatives

- SHERPA/ RoMEO online resource to check publisher copyright & self- archiving policies
- Software tool to identify predatory publications developed by SPPU
- Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Publication Misconduct

Group Discussions

Subject specific ethical issues, FFP, authorship

Conflict of interest, Complaints and appeals: examples and fraud from India and abroad

Software tools

Use of plagiarism software like Turnitin, Urkund and other open source software tools

Databases and Research Metrics

Databases

- Indexing databases
- Citation databases: Web of Science, Scopus, etc.

Research Metrics

- Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
- Metrics: h- index, g index, i10 index, altmetrics

Course code: PAST-603

Course name: Seeds Laws and DUS Testing for Plant Variety Protection

Credits: 4 (2:1:1)

Objective

To apprise students with the legislative provisions and processes and the mechanisms of seed quality control. Also provide a comprehensive understanding of DUS testing, its conduct and significance to PVP.

Theory

UNIT I

Genesis of plant variety protection (PVP); International Union for Protection of New Varieties of Plants (UPOV) and its functions; General agreements on Tariff and Trades (GATT) agreement in relation to protection of plant varieties; Protection of Plant Varieties and Farmers Rights (PPV & ER) Act, 2001; PPV & FR rules, 2003.

UNIT II

Criteria for protection of new varieties of plants; principles and procedures of Distinctness, uniformity and Stability (DUS) testing; test guidelines, planting material, duration, testing options, varieties of common knowledge, reference collection, grouping of varieties, types and categories of characters; technical questionnaire.

UNIT III

Assessment of DUS characters based on morphological, biochemical and molecular markers; statistical procedures; computer software for use in DUS testing

Course code: PAST-604

Course name: Hybrid Seed Production

Credits: 4 (2:1:1)

Objective

To provide a comprehensive knowledge and practical exposure to hybrid seed production in field and vegetable crops.

Theory

UNIT I

Heterosis: definition, expression and estimation of hybrid vigour; utilization of heterosis in agricultural, horticultural and other crop plants for crop improvement.

UNIT II

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.

UNIT III

Techniques of hybrid seed production – emasculation 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.

UNIT IV

Fertility restoration; use of chemical hybridizing agents, problems of non synchrony in flowering of parental lines and methods to overcome; planting ratios and population density in relation to

hybrid seed yield; salient features of hybrid seed production of various crops viz. rice, sorghum, bajra, maize, sunflower, cotton and other major vegetables.

Practical

Methods of hybrid seed production in major agricultural and horticultural crops; planting of rows/blocks of parental lines and manipulations for achieving flowering synchrony for production of hybrid seeds, maintenance of A, B and R lines and production of breeder seed; stable diagnostic characteristics of parental lines and their hybrids; genetic purity tests; determination of cost of hybrid seed production of various crops; visit to seed production plots etc.

Course code: PAST 605

Course name: Testing for Genuineness & Purity of Cultivars

Credits: 4 (2:1:1)

Objective

To provide hands-on training on various field and laboratory methods of testing purity of cultivars.

Theory

UNIT I

Objective of cultivar purity test, general principles and methods involved. Use and limitations of laboratory, green house and field plot methods in determination of genuineness of cultivars; a case study in hybrid cotton, reporting of results and inference.

UNIT II

Chemical-biochemical tests for species and cultivar purity: phenol test, seed and seedling tests, electrophoretic analysis of seed protein, isozymes etc, use of chromatography for analysis of secondary compounds etc.

UNIT III

DNA finger printing (RAPD, SSR, AFLP etc) and their use in varietal purity testing and registration of new varieties.

UNIT IV

Use of computer-based machine vision (MVT) for varietal identification and purity testing.

Practical Chemical and biochemical tests for species and cultivar purity: phenol test, seed and seedling tests, electrophoretic analysis of seed protein and isozymes, DNA fingerprinting using PCR techniques, use of chromatography for analysis of secondary compounds.

Suggested Readings

- Basra AS. (Ed.). 1995. Seed Quality: Basic Mechanisms and Agricultural Implications. Food Product Press. ISTA 2006. Handbook of Variety Testing. International Seed Testing Association, Switzerland.

Course code: PAST 606

Course name: Emerging Trends in Seed Quality Enhancement

Credits: 4 (2:1:1)

Objective

To update knowledge on seed quality enhancement technologies and their application.

Theory

UNIT I

Concept and significance of seed quality enhancement; physical, chemical and pesticidal seed treatments, history, principles and methods of seed treatment, methodology and factors affecting seed enhancement treatments.

UNIT II

Seed priming: physiological and biochemical basis, types of priming technology, biochemical and molecular changes associated, pre-germination, film coating and pelleting, seed tapes, seed mats, seed colouring, biopriming.

UNIT III

Synthetic seeds – Aim and scope for synthetic seeds, historical development, somatic embryogenesis, somaclonal variation and their control, embryo encapsulation systems, hardening of artificial seeds, cryopreservation, storage of artificial seeds, desiccation tolerance, use of botanicals in improving seed quality etc.

UNIT IV

Seed biotechnology; genetic analysis and QTL mapping, synthetic seed, terminator technology, tarter technology

Practical

Seed treatments – methods and techniques, equipments required for seed treatment, film coating; seed invigoration/priming – hydration and dehydration, PEG priming, solid matrix priming, bio priming, effects of priming; methods for hydrogel encapsulation of artificial endosperm, hydrophobic coating etc.; protocols for production of synthetic seeds, Visit to leading Seed companies to study the seed treatment processes.

Suggested Readings

- Seed technology 2nd Revised and enlarged edition khare and M.S. Bhale Scientific publishers.
- Practical manual seed science and technology
- Black, M. and Bewley JD. (Eds.). 2000. *Seed Technology and its Biological Basis*. Sheffield Academic Press.

Course code: PAST-700

Course name: Advances in Seed Science Research

Credits: 4 (2:1:1)

Objective

To provide knowledge on the advances in various aspects of seed science & their application in seed technology.

Theory

UNIT-I

Physiological and molecular aspects of seed development, germination and dormancy; desiccation and stress tolerance mechanism; seed longevity and ageing; structural changes in membranes of developing seeds during acquisition of desiccation tolerance; dehydration damage and repair in imbibed seeds.

UNIT-II

Modern techniques for identification of varieties and hybrids; principles and procedures of electrophoresis, DNA fingerprinting and other molecular techniques and their utilization; techniques for improving seed quality; proteomic analysis; seed priming, coating, pelleting and synthetic seeds; GM seeds and their detection, terminator technology (GURT).

UNIT-III

Detection and identification of seed borne fungi, bacteria, viruses, nematodes and insect pests through advanced techniques like ELISA, PCR based techniques etc.

UNIT-IV

Recent developments in seed laws, policies and seed certification system in India and its comparison with OECD seed certification schemes; IPR systems and PVP internationally.

Suggested Readings

- Bewley J.D., Bradford K.J., Hilhorst H.W.M. and Nonogaki H. 2013, Seeds; Physiology of Development, Germination and Dormancy. Third Edition. Springer publication.
- Copland L.O. and McDonald M.B. 2014. Seed Science and Technology. Forth Edition. Springer Publication.
- Bench, A.L.R. and Sanchez, R.A. 2004. Handbook of Seed Physiology. Food Product Press.
- Black, M. and Bewley JD. (Eds.). 2000. Seed Technology and its Biological Basis. Sheffield Academic Press.
- Nicolas, G., Bradford, K.J., Come, D. and Pritchard, H.W. 2003. The Biology of Seeds, Recent Research Advances. CABI.

Learning outcomes:

After successful completion of Ph.D. Seed Science and Technology course programme, students apprise about the knowledge of advance techniques of seed production, seed biology, quality maintenance and testing. Students are also got the expertise in statistical methods and their application in seed technology research.