

SANT GADGE BABA AMRAVATI UNIVERSITY AMRAVATI



THREE-YEAR UNDERGRADUATE PROGRAMME

Bachelor of Science (B.Sc.)

Subject: SEED TECHNOLOGY

FACULTY: SCIENCE AND TECHNOLOGY

**(Courses effective from Academic Year 2026-2027
Under Uniform NEP 2020)**

Syllabus

**Semester I and II
Semester III and IV
Semester V and VI**

THREE YEAR UNDERGRADUATE PROGRAMME
B.Sc. SEED TECHNOLOGY
FACULTY: SCIENCE AND TECHNOLOGY
SantGadge Baba Amravati University
FACULTY: Science and Technology
(Three Years- Six Semesters Bachelor's Degree Programme)

Preamble:

Welcome to the Undergraduate Program in Seed Technology, an immersive and comprehensive journey into the world of plant seed sciences. At the heart of this program lies a commitment to nurturing a deep understanding and appreciation of the plant kingdom, from the molecular to the ecosystem level. This curriculum is thoughtfully designed to blend rigorous scientific inquiry with practical applications, ensuring our students emerge as well-rounded, skilled, and knowledgeable botanists.

This program offers a rich tapestry of courses that cover a wide spectrum of botanical sciences. From exploring the theoretical foundations in plant science and delving into the diversity of microbial life to hands-on experimentation in plant pathology and advanced studies in genomics, proteomics, and metabolomics, the program provides an all-encompassing educational experience. These major courses are complemented by specialized vocational skill courses and skill enhancement courses, meticulously structured to bridge the gap between academic learning and vocational expertise. Students engage in in-depth studies of medicinal plant cultivation and processing, seed development technology, and nursery and garden management, seamlessly connecting these skills to practical vocational applications like commercialization, supply chain management, and entrepreneurship. In addition to the core and vocational curricula, this program offers elective courses in critical areas like plant systematics, seed physiology, and disease systematics and managements, further broadening our students' scientific horizons.

The graduates are not just academically proficient; they are also equipped with practical skills, an ethical mindset, and the capability to innovate and adapt in the dynamic field of See

Technology. They emerge as individuals who are ready to contribute to scientific research, industry, environmental conservation, and academia. This program is an invitation to embark on a journey of discovery, learning, and growth in the fascinating world of plants, preparing students to become leaders and innovators who will shape the future of botanical sciences and contribute positively to society and the environment.

Core Competencies:

Based on the guidelines provided by the University Grants Commission under the National Education Policy 2020, the Graduate Attributes for the Discipline of Seed Technology for the Undergraduate Program at Sant Gadge Baba Amravati University can be defined as follows:

Seed Identification and Comparison: Ability to recognize and differentiate between major seed crop plants .

Understanding Plant Seed Evolution and Diversity: Comprehend the evolutionary process and genetic diversity, analyzing plant seed functions and metabolism at various biological levels.

Adaptation, Development, and Behavior Analysis: Insight into the adaptation, development, and behavioral aspects.

Ecosystem Understanding: Grasping the interconnectedness of life, tracing energy and nutrient flow, and understanding ecological relationships.

Analytical and Problem-Solving Skills

Research and Practical Problem Addressing: Utilization of scientific methods for hypothesis formulation, data collection, and critical analysis.

Critical Thinking: Enhanced understanding of fundamental concepts and their application in scientific principles, fostering problem-solving capabilities.

Digital Proficiency

Integration of Digital Tools: Acquiring digital skills and amalgamating fundamental concepts with modern technological tools.

Ethical and Psychological Development

Ethical and Moral Values: Strengthening ethical and moral principles, coupled with psychological resilience.

Teamwork

Collaboration Skills: Developing abilities to work efficiently in teams for institutional, industrial, and societal contributions.

Independent Learning

Self-directed Learning: Acquiring knowledge and skills for higher studies, competitive examinations, and employment readiness.

Additional Learning Outcomes

Critical Evaluation: Ability to critically assess plant seed information, understanding their classification.

Creative Problem Solving: Independently formulating solutions through interdisciplinary experiences.

Taxonomical Interpretation: Skill in using taxonomical information for plant classification. Scientific Method Application: Proficiency in applying scientific methods to botanical questions.

Communication Skills: Effective presentation of scientific hypotheses and data, both orally and in written formats.

Literature Review: Ability to access and evaluate primary literature in See Technology.

Application of Mathematical and Physical Principles: Using mathematical tools and physical principles in biological contexts.

Ecological Interconnectedness: Explaining ecological relationships and energy and nutrient flow in the environment.

Experimental Proficiency: Demonstrating expertise in experimental techniques and methods within See Technology.

Curriculum Framework

Multidisciplinary and Holistic Education: Offering a comprehensive, in-depth, and focused curriculum that is student-centric and outcome-based.

Innovation and Curiosity: Promoting experiential learning, hands-on training, field studies, and internships to foster innovation and curiosity.

Adaptation to Modern Technology: Keeping abreast with the latest developments in plant sciences and technology.

Career Readiness: Equipping students with knowledge, competencies, and professional skills for the job market.

These attributes are designed to create well-rounded, skilled, and knowledgeable graduates who are ready to contribute effectively in their chosen careers and as responsible citizens.

Graduate Attributes

Graduate Attributes for a Seed Technology program encapsulate the essential qualities, skills, and understandings that a student is expected to acquire throughout their academic journey. These attributes are meticulously designed to prepare graduates for diverse roles in scientific research, industry, environmental conservation, and academia. They reflect a blend of theoretical knowledge, practical skills, technological proficiency, and ethical understanding. Importantly, these attributes also foster a mindset of lifelong learning, adaptability, and innovation. Graduates are expected to not only excel in their scientific endeavors but also contribute positively to societal and environmental challenges. By integrating knowledge from various sub-disciplines of Seed Technology, students are equipped to approach complex problems holistically and innovatively, making them valuable assets in any professional setting they choose to pursue.

Graduate Attributes specifically with the Major Courses, Vocational Skill Courses, Skill Enhancement Courses, and Elective Courses you've listed. This will provide a comprehensive picture of the attributes expected from students graduating from this See Technology program.

Practical and Laboratory Skills: Gain hands-on experience in practical techniques in microbial studies, plant pathology, cell biology, cytogenetics, and various experimental approaches, preparing students for real-world scientific challenges.

Technological and Analytical Proficiency: Achieve expertise in using modern technologies in plant science. This includes proficiency in bioinformatics, genetic engineering, molecular biology, and data analysis techniques, crucial for research and industry applications.

Entrepreneurial and Business Skills: Develop skills in commercialization, supply chain management, seed development technology, entrepreneurship, and nursery and garden management, preparing students for business ventures in Seed Technology.

Interdisciplinary Integration and Innovation: Ability to integrate knowledge from plantseed physiology, molecular biology, and fungal systematics, and apply innovative solutions to challenges in the field of Seed Technology.

Communication and Collaboration Skills: Develop strong communication skills for conveying complex Seed concepts clearly and collaborating effectively in interdisciplinary teams.

Global Perspective and Societal Impact: Awareness of the global and societal impact of plant sciences, including the role of plant seed in addressing issues like food security and climate change.

Critical Thinking and Problem Solving: Foster critical thinking and problem-solving skills, essential for tackling complex scientific questions and challenges in seed technology.

Research and Inquiry: Encourage a strong foundation in research methodology and inquiry, essential for contributing to the growing body of knowledge in seed science and related fields.

The structure of the Vocational Skill Courses and Skill Enhancement Courses in this seed technology program is strategically designed to provide students with a comprehensive skill set that enabling students to grasp the business aspects of the seed industry, including market analysis, product development, and sales strategies.

Similarly, the course on "Seed Development Technology" equips students with the technical know-how in seed science and technology. This knowledge is complemented by the "Supply Chain Management in Seed Products" course, which teaches students the logistics and management skills required to effectively distribute seed products in the market. In the realm of horticulture, the course "Skilling Botanists for Nursery and Garden Management" provides practical skills in nursery operations and garden management. This is synergistically linked with the vocational course "Nursery and Garden Management," focusing on the entrepreneurial aspects of running a nursery or garden business, including financial management, marketing, and customer relations.

This cohesive and integrated educational approach ensures that students are not only well-versed in theoretical and practical aspects of Seed Technology but also equipped with the necessary skills to turn their knowledge into successful vocational pursuits. This alignment of skills with vocational outcomes is key to providing students with a clear and achievable career path post-graduation.

Program Outcomes

Program Outcomes for an Undergraduate Seed Technology Program, especially one with a comprehensive curriculum like the one, involves articulating the specific knowledge, skills, and attitudes students are expected to possess upon graduation. Following are the Program Outcomes:

Scientific Knowledge and Understanding: Graduates will demonstrate a thorough understanding of seed biology, including the study of seed development, microbial diversity, plant pathology, and advanced topics like genomics, proteomics, and metabolomics.

Practical and Experimental Skills: Graduates will acquire hands-on skills in various laboratory techniques and experimental approaches in seed science, enabling them to conduct scientific investigations effectively.

Technological Proficiency: Graduates will be adept in using modern technologies and tools relevant to seed and plant sciences, including bioinformatics, genetic engineering, and analytical software.

Entrepreneurial and Business Acumen: Graduates will possess skills in entrepreneurship and business management, particularly in areas such as seed commercialization, seed product management, and nursery and garden management.

Interdisciplinary Integration: Graduates will be able to integrate knowledge across various sub-disciplines of Seed Technology, applying them to solve complex problems in seed science and related fields.

Communication Skills: Graduates will develop strong communication skills, capable of effectively conveying Seed science concepts and findings to diverse audiences, both in academic and industry settings.

Ethical and Societal Understanding: Graduates will have a deep appreciation of the ethical implications and societal importance of plant sciences, particularly in areas like genetic engineering and conservation.

Research Competence: Graduates will be proficient in scientific research methodologies, enabling them to contribute to the expansion of knowledge in seed sciences.

Global Perspective and Societal Contribution: Graduates will recognize the global challenges and opportunities in Seed technology and will be prepared to contribute to societal needs and environmental conservation efforts.

Career Readiness and Adaptability: Graduates will be ready for a variety of career paths in seed technology and related fields, equipped with the adaptability and lifelong learning skills necessary to navigate a dynamic professional landscape.

Innovation and Problem-Solving Skills: Graduates will have the ability to apply creative and critical thinking to innovate and solve problems in the field of seed technology.

These Program Outcomes ensure that graduates from the Seed technology program are not only academically proficient but also ready to apply their knowledge and skills in practical, research, and entrepreneurial settings, contributing positively to the field of plant sciences and the broader community.

TLE Scheme for FIRST YEAR: SEMESTER – I

Mode of Teaching	Vertical No.	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major / Minor	Theory1	131200	Basics of Seed Technology and Development of Career	2	2	6
			Lab/Practical-1	131201	Basics of Seed Technology	2	4	
	b.	Minor / Major	Theory1	-	-	2	2	6
			Lab/Practical-1	-	-	2	4	
	c.	Generic/Open Elective	Theory1		Refer University basket	2	2	4
			Theory2		Refer University basket	2	2	
	d.	VSC	-	-	-	-	-	4
		SEC	Lab/Practical-2	131203	Organic Farming	2	4	

\$ Minor Subject opted by the Student

TLE Scheme for FIRST YEAR: SEMESTER – II

Mode of Teaching	Ver. No	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major / Minor	Theory2	131204	Seed production planning in plant breeding	2	2	6
			Lab/Practical-3	131205	Seed production planning and crop improvement	2	4	
	b.	Major / Minor	Theory2		-	2	2	6
			Lab/Practical-5		-	2	4	
	c.	Generic/ Open Elective			Refer University basket	2	2	4
					Refer University basket	2	2	
	d.	VSC	Lab/Practical-6	131206	Seed pathology	2	4	8
		SEC	Lab/Practical-7	131207	Landscaping	2	4	

\$ Minor Subject opted by the Student

*** Important:**

- VSC Should be Complementary to Major/Minor
- SEC has to be selected from the Basket Provided by University, from the same Faculty/Discipline of the Major/Minor

Notes:

- a. The strength of the batch of the Practical for UG Classes shall be 16 with an addition of 10% with the permission of Hon'ble Vice Chancellor. However, for Music Discipline the batch size shall be of 7 students. The number of the students required to constitute a batch or calculate the workload shall be in accordance with the relevant Government Resolution in force at the time, applicable to specific time, region, course type, mode of instruction, and other pertinent factors.
- b. 1 Credit shall mean 1 Hour Teaching per Week per Semester (Total 15 Hrs/ Semester), the duration of 1 Teaching Period will be 60 Minutes. For Practical 1 Credit shall mean 2 Hour Teaching per Week per Semester (Total 30 Hrs/ Semester).
- c. For Examination and Evaluation of Theory Courses, 40 % Marks shall be assigned to Internal Examination and 60% Marks shall be assigned to end-semester external university examination.
- d. **Co-curricular Courses:** Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I, II, III, IV, V and VI. These courses may be taught by Physical Education Director or may be assigned to Language Teacher by the Principal of HEI based on the expertise of the concerned.
- e. Value Education Courses to be selected from the Basket of Courses provided by the University. These courses may be assigned to the Language Teacher by the Principal of HEI based on the expertise of the concerned.
- f. **Generic / Open Elective Courses (GE/OE):** Courses to be selected from the Basket of Courses provided by the University
- g. **Abbreviations:** Department Specific Core: DSC, Department Specific Elective: DSE, FSC: Faculty Specific Core, FSE: Faculty Specific Elective, Indian Knowledge System: IKS, Inter Faculty Specific Core: IFSC, Inter Faculty Specific Elective: IFSE, Theory : Th, Practical/Practicum: Pr, Environment Studies: ES, Pre-requisite Course mandatory if applicable: Prq, Laboratory: Lab (Practical), Generic/ Open Electives: OE; Vocational Skill and Skill Enhancement Courses: VSEC; Vocational Skill Courses: VSC; Skill Enhancement Courses: SEC; Ability Enhancement Courses: AEC; Value Education Courses: VEC; OJT: On Job Training: Internship/ Apprenticeship; Field projects: FP; Community Engagement and Service: CES; Co-curricular Courses: CC; RM: Research Methodology; Research Project: RP; MIL: Modern Indian Language

Examination and Assessment Process:

- i. The basic principle of the Credit framework is that Credits are a function of the successful completion of a program of study/ vocational education/ training and assessment. No Credit can be earned by the student unless the student is assessed for the achievement of the desired competencies and outcome of a program.
- ii. Exit options are provided with Certificate, Diploma and Basic Bachelor's degrees to the students at the end of the second, fourth and sixth semesters of a Four Years Multidisciplinary Degree Programme. Students will receive a Bachelor's degree with Honors/ Research on successfully completing of all eight semesters of the UG Program either at a stretch or with opted exits and re-entries.
- iii. For the smooth success of four-year degree programme with multiple entry and exit systems, the examination mode should be based on the combination of innovative trends in formative (informal and formal tests administered during the learning process) and summative (evaluation of students learning at the end of an instructional unit) examination modes in line with the UGC Report on 'Evaluation Reforms in Higher Educational Institutions (2019).

Examination, Evaluation and Assessment Scheme

The total marks for each Course shall be based on Continuous Assessment and Semester End Examination.

Each theory course of Major, Minor, GE/OE, AEC, IKS, VEC as mentioned in **Teaching Learning Scheme** prepared by the Board of Studies shall be evaluated as per the scheme as mentioned in the following table -

Table: Examination, Evaluation and Assessment Scheme

Vertical No.	The Vertical	Mode of Examination, Evaluation & Assessment	Theory				Theory (Total)		Practical				Practical (Total)	
			External		Internal		Max. Marks	Min. Marks	External		Internal		Max. Marks	Min. Marks
			Max. Marks	Min. Marks	Max. Marks	Min. Marks			Max. Marks	Min. Marks	Max. Marks	Min. Marks		
a	Major	External & Internal	30	9	20	6	50	20	25	10	25	10	50	20
b	Minor		30	9	20	6	50	20	--	--	--	--	--	--
c	Generic/ Open Elective		30	9	20	6	50	20	--	--	--	--	--	--
d	VSC	Internal	--	--	50	20	50	20	--	--	50	20	50	20
	SEC	Internal	--	--	50	20	50	20	--	--	50	20	50	20
e	AEC (Eng. & One MIL Composite)	External & Internal	30	9	20	6	50	20	--	--	--	--	--	--
	IKS (Generic)	External & Internal	30	9	20	6	50	20	--	--	--	--	--	--
	VEC	External & Internal	30	9	20	6	50	20	--	--	--	--	--	--
f	Internship/ Apprenticeship	Internal	Assessment of these verticals shall be based on various activities/practices. It shall be evaluated by giving maximum marks of 50 per 2 Credit Course with separate activity weightages/levels. A detailed SOP for this assessment process shall be prescribed separately.											
	FP/CEP													
	CC													

Continuous Assessment Tests (CAT)

For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under-

- i. Three CAT each of 8 / 10 Marks (Theory) as applicable and 10 Marks (Practical).
 - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
 - Second on completion of 50% Syllabus of the course or on completion of 50 teaching days,
 - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days.
- ii. Each concurrent assessment (CAT-I, II & III) will be mapped to relevant Course Learning Outcome.
- iii. Total Performance in CAT (i.e. 40 %) shall be based on the **best two out of three** in CAT examinations
- iv. Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, record book, seminar, case study,

field work, mini project work, quiz or any innovative method, which may be deemed to be appropriate for assessing the relevant course outcome.

Conduction of the Examination:

As per the scheme of teaching, learning, examination and evaluation, theory/practical examinations of Semester-I, II, III, IV, V, VI, VII and VIII shall be conducted by the University (except for Internal Examinations as applicable) at the end of each semester.

The theory/practical examinations of all the Semesters shall be held as per the following Schedule –

Sr. No.	Name of the Examination	End Sem Examination	Supplementary Examination*
1	Semester-I, III, V and VII	Winter	Summer
2	Semester-II, IV, VI and VIII	Summer	Winter

The University may evolve mechanism for conducting repeat end semester examination. Such repeat examinations shall have to be conducted within one month of the regular even semester examination and on demand examination.

1. The practical examination of all semesters shall be conducted by the University at the end of each semester. The HEI shall conduct the Practical examination of odd semesters as per the schedule announced by the University. **However, the appointment of the External and Internal Examiners shall be done by the Head or Principal of respective HEI to conduct external examination of the odd semester and the same should be communicated to the University before commencement of the practical examination.** The University shall conduct the external practical examination of all even semester by appointing external and internal examiners.
2. The examinations specified above shall be held twice in a year at such places and on such dates as may be prescribed by the University.
3. An applicant to an examination specified above, shall pursue a regular course of study in courses prescribed for the examination concerned for not less than one semester in a particular semester in a College/Institute/University department.
4. Provided that the student shall be eligible to appear for examination if -
 - a. He/she complies with the provisions of the Ordinance pertaining to the Examination in general from time to time.
 - b. He/she has prosecuted a regular course of study in a university department/college affiliated to the University.
 - c. He/she has in the opinion of the Principal shown satisfactory progress in his/her studies.
5. The provisions of Ordinance No. 6 and Ordinance No. 9 shall be *mutatis-mutandis* applicable to every collegiate/non-collegiate student.
6. The fees for each theory examination and practical examination conducted by the university shall be as prescribed by the University, from time to time.

THREE YEAR UNDERGRADUATE PROGRAMME

B.Sc. Seed Technology

FACULTY: SCIENCE AND TECHNOLOGY

SEMESTER – I

Vertical	Type of Course	Course Code	Course Name
Major	Major/ Minor	131200	Basics of Seed Technology and Development of Career
Major	Lab/Practical-1	131201	Basics of Seed Technology
VSC	Lab/Practical-2	-	-
SEC	Lab/Practical-3	131203	Organic Farming

SEMESTER – II

Vertical	Type of Course	Course Code	Course Name
Major	Major/Minor Theory	131204	Seed production planning in plant breeding
Major	Lab/Practical 2	131205	Seed production planning and crop improvement
VSC	Lab/Practical-5	131206	Seed pathology
SEC	Lab/Practical-6	131207	Landscaping

Syllabus for Major Courses

Semester I: Major Theory I

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	131200	Basics of Seed Technology and Development of Career	2	30	2 Hrs	30

Course Objectives:	1. To promote the possibility of self-employment 2. To enrich students training and knowledge that would be useful in seed industry so that the farmers will get quality seeds. 3. To introduce the concept of experimental design in seed technology. 4. To help students build up a progressive and successful career in industries with a Biotechnological perspective.					
Course Outcomes:	CO-1: Understand development, structure and physiology of seeds CO-2: Analyse the developmental stages in the embryogenesis of angiosperm plants. CO-3: Classify different modes of reproduction in angiosperms. CO-4: Demonstrate various factors causing flowering and seed development. CO-5: Apply the understanding of seed development and germination in different fields of agriculture. CO-6: Apply plant breeding as the tool in crop hybridization.					
Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies		
	1.1: Seed structures and texture, Endosperm and embryo development Immature seed and germination. 1.2 Polyembryony and Apomixis. 1.3 Classification of fruits and seed. 1.4 Physiological and Harvestable maturity	8	8			
Unit II	2.1 Flower structure, megasporangium, female gametophyte development 2.2 Microsporangium, male gametophyte development . 2.3 Pollination, Autogamy, Allogamy	7	7			
Unit III	3.1 Morphology of seeds for variety identification. Variety descriptors ; importance in variety release 3.2 General Introduction to plant breeding : Definition, history, nature, scope, objectives 3.1 Mode of reproduction in plants : Asexual and Sexual reproduction	8	8			

Unit IV	4.1 Pollination : self -pollination and cross pollination; agencies for cross pollination (air, insects, water and animals) 4.2 Indian Agricultural Research Institute, NBPGR, Krushi Universities and their role plant breeding and Seed growing crops 4.3 Industrial base for hybrid seed technology	7	7	
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Practical:

Conduct Any Seven Exercises from the following:

1. Morphology of Dicot Seeds.
2. Seedling morphology and adult plant morphology in some major crops for identification in green house experiment .
3. Phenol test in wheat and paddy.
4. Peroxidase test, 2-4D Test.
5. GA test in wheat and other crops
6. Microscopic Examination of Plant Cells
7. To Study the Phenomenon of Photosynthesis
8. To Study of the Process of Seed Germination
9. Morphological study of Any One Plant Seed
10. Application of Artificial Intelligence (AI) in Plant Sciences

Activities:

1. Photographic herbarium of seed growing plants.
2. Field visits to sustainable Business Ventures for Cultivation of the Seed crops / Seed Product / Extraction Industry, etc.

References:

DIGITAL RESOURCES:

- <http://www.theplantlist.org/> A comprehensive database of plant taxonomy and systematics.
- <https://www.plantae.org/> Webinars and educational resources on various plant biology topics.
- <https://www.ibiology.org/plant-biology/> iBiology Plant Biology Talks and lectures by leading researchers in plant cell and molecular biology.
- <https://www.nature.com/subjects/plant-sciences> Access to articles and latest research in plant science.
- <http://www.fao.org/elearning/#/elc/en> Courses on crop improvement and genetic engineering by FAO e-learning Centre.
- <https://gmoanswers.com/> Resource for information on genetically modified crops.
- AgriMOOC by AgriLife Learn: Online courses on modern agriculture, crop improvement, and sustainability.
- <https://www.sare.org/> Resources and courses on sustainable agricultural practices especially for Sustainable Agriculture Research & Education.
- <https://www.biotecharticles.com/> Articles on plant biotechnology in various industries.
- <https://plantbasednews.org/> Latest news and developments in plant-based industries.
- <https://www.environmentalscience.org/> E-content on environmental botany and related topics.
- <https://www.ted.com/topics/climate+change> Inspirational TED Talks on Climate Change

and talks related to plants and environmental issues.

- Synthetic Biology MOOC by edX: Online course on synthetic biology, including plant applications.
- <https://www.plantae.org/research/crispr/> Information and updates on CRISPR technology in plants as Plantae's CRISPR Resources.
- <https://www.scholarship-positions.com/> Information on scholarships for higher studies in plant sciences.
- <https://www.linkedin.com/learning/> Courses on career development and industry readiness on LinkedIn Learning.
- <https://www.researchgate.net/> Platform to explore research papers and contributions from various institutes on ResearchGate.
- <https://www.kaggle.com/> Data science competitions and datasets relevant to plant sciences.
- <https://ocw.mit.edu/index.htm> Free course materials on topics like innovation and entrepreneurship by MIT OpenCourseWare.
- <https://www.scidev.net/global/> Articles on science communication and the ethics of scientific research by SciDev.Net.

REFERENCE BOOKS, TEXT BOOKS, RESEARCH ARTICLES:

1. Agrawal R.L. Seed Technology Oxford IBH.
2. Choudhary R. C. 1982. Introduction to plant breeding Oxford and IBH, Publishing co., New Delhi.
3. Singh B. D. 1990, Plant breeding Principles and methods Kalyni publisher, New Delhi.
4. Simmonds N. W. 1979. Principles of crop improvement Longman, New-york.
5. Strickberger N W. 1985. Genetics, McMillan publishing co., New-york.
6. Gupta. P. K. 1991. Genetics Rastogi Publication co., Meerut.
7. Frankel R. and Galun E. 1977. Pollination mechanisms, Reproduction and plant Breeding, Springer-Verlag, Berlin.
8. Poehlman J. M. and Borthakur, D. 1972. Breeding Asian Field Crops. 121 122 Oxford and IBH publishing co., New Delhi.
9. Chopra V. L. Year plant breeding theory and practice. Oxford and IBH publishing co., New Delhi.
10. Agrawal P. K. and Dadlani M. 1990. Techniques in seed science and Technology. South Asian publisher, New Delhi.
11. Kahate P.M., Gudadhe S., Zade R.V. and Verma S. 2023. Frontiers in Life Science Volume XI, First Edition, Bhumi Publishing, Kolhapur.

National Case Studies:

- Patanjali Ayurved Limited
- Amul's Fodder Development Programs
- Nurture.Farm:
- Barrix Agro Sciences
- Tata Coffee's Sustainable Practices
- Padma Shri Subhash Palekar's Zero Budget Natural Farming (ZBNF)
- Sikkim's Organic Farming Revolution
- Punjab's Happy Seeder Innovation for Stubble Management
- Kerala's Jackfruit Revolution by James Joseph

International Case Studies:

- Netherlands' Greenhouse Horticulture
- Australia's Bush Heritage:
- Israel's Agricultural Innovation
- China's Medicinal Plant Industry and Traditional Chinese Medicine
- Costa Rica's Reforestation Efforts and Ecotourism

Pedagogical Strategies

To effectively teach and evaluate the course " **Basics of Seed Technology and Development of Career**," a blend of classical and contemporary pedagogical strategies is essential. These strategies should be tailored to enhance the delivery and comprehension of the course content within each unit, aligning with the educational objectives and learning outcomes.

Teachers may adopt any one of the strategies suggested below as the time, space and classroom situations permits -

Unit I: Foundations of Seed technology and Plant Biology**1. Flipped Classroom Approach:**

- Pre-class Assignments: Reading materials and video lectures on basic Seed Technology concepts and seed sciences .
- In-class Activities: Discussion forums, Q&A sessions, and interactive quizzes.

2. Project-Based Learning:

- Students can undertake projects on local crop plant and wild plant, analyzing diversity, taxonomy, and systematics.
- Field trips to agricultural fields for practical taxonomy exercises.

3. Case Studies and Problem-Based Learning:

- Use case studies to explore historical and modern developments in seed technology.
- Problem-solving sessions focused on ecological challenges and physiological processes of seed plants.

4. Laboratory Work and Hands-on Experiments:

- Practical sessions on cell and molecular biology, including microscopy and genetic experiments.
- Experiments to observe physiological processes like photosynthesis and respiration.

Unit II: Applied Seed Sciences and Industry Perspectives**1. Interactive Lectures with Guest Speakers:**

- Invite industry experts to discuss the role of plants in various seed hybridization industries.
- Seminars on agricultural botany and sustainable practices.

2. Group Projects and Collaborative Research:

- Students work in groups on projects related to environmental botany, crop improvement, or seed-based industries.
- Collaborative research projects using online databases and scientific literature.

3. Simulation and Modeling:

- Use of software tools to simulate genetic editing and plant breeding techniques.
- AI and Machine Learning models to understand phenomics and high-throughput phenotyping.

4. Virtual Field Trips and E-learning Tools:

- Virtual tours of biotech companies and agricultural fields.
- Online resources and interactive modules for learning advanced concepts.

Unit III: Career Development and Research Opportunities

1. Workshops and Career Counseling Sessions:

- Workshops on career planning, higher study opportunities, and understanding the corporate world in seed sciences.
- Counseling sessions focusing on skill development for industry readiness.

2. Mock Interviews and Resume Building Workshops:

- Practice sessions for competitive examinations and entrance tests.
- Guidance on building a professional resume and portfolio.

3. Research Paper Analysis and Group Discussions:

- Analyzing and discussing research papers from leading plant science institutes.
- Group discussions on various lines of research and their contributions.

4. Networking Events and Industry Visits:

- Organize networking events with alumni and professionals in the field.
- Visits to research institutes and corporate offices in the plant science sector.

Unit IV: Innovation, Communication, and Ethics in Plant Sciences

1. Case-Based Learning and Role-Playing:

- Case studies on innovations in plant sciences.
- Role-playing exercises to explore ethical dilemmas and legal aspects in biotechnology.

2. Entrepreneurship Workshops:

- Workshops on starting a business in plant-based industries, including case studies and market analysis.
- Pitching sessions for hypothetical start-up ideas.

3. Communication Skills Development:

- Training sessions on scientific writing, public speaking, and presentation skills.
- Conduct mock conferences where students present research papers or reviews.

4. Debate and Discussion Forums:

- Organize debates on controversial topics like GMOs, bio-fortification, and seed-based meat alternatives.
- Discussion forums to reflect on ethical, legal, and societal implications of seed science innovations.

Each of these strategies aims to engage students actively, foster critical thinking, and provide practical skills relevant to their future careers in plant sciences. Integrating these diverse teaching methods will cater to different learning styles and ensure a comprehensive understanding of the course material.

Question Paper for External Practical Course

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXAMINATION B.Sc. I (Seed Technology), SEMESTER – I (NEP)			
Lab/Practical-1	Course Code: 131201	Basics of Seed Technology	Max Marks: 25
Question No.	Exercise		Marks
1	Perform Major Experiments (Any one)		10
2	Perform Minor Experiments (Any one)		5
4	Spotting		5
5	External Viva Voce		5
	Total		25

Assessment of Rubric for Internal Practical Course

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXAMINATION B.Sc. I (Seed Technology), SEMESTER – I (NEP)			
Lab/Practical-1	Course Code: 131902	Basics of Seed Technology	Max Marks: 25
Question No.	Exercise		Marks
1	Record/ Assignment		5
2	Attendance		5
3	Participation in activity/Field visit report		5
4	Students Overall Performance throughout the semester		5
5	Internal Viva Voce		5
	Total		25

Semester I: Skill Enhancement Course

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	131203	Organic Farming	2	30	2 Hrs	30

Course Objectives:	1. To enrich students training and knowledge that would be useful in landscaping. 2. To introduce the concept of experimental design in gardening. 3. To help students build up a progressive and successful career in industries with a Garden development
Course Outcomes:	CO-1: Understand development, structure of landscaping CO-2: Analyse the developmental stages in the Garden development CO-3: Demonstrate various factors causing development and flourishing of plants in gardens.

Unit System	Contents	Work load Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	History, development, methods, advantages and limitations, future prospective in concern of organic farming with India and World	8	8	Suitable pedagogical strategies are separately annexed
Unit II	Definition, Process, Causes, Limitation and advantages of various processes like Nutrient cycle, eutrophication, Decomposition.	7	7	
Unit III	Plant nutrient – Micro, macro, importance and deficiency symptoms, Sources of green manure.	8	8	
Unit IV	Land preparation, Seed bed, manuring, sowing, watering and raising of seeding	7	7	

Activities:

1. Visited local organic farming fields and discuss with farmers.
2. Prepare manure from decomposed plant materials.
3. Survey of green manure from local areas.
2. Prepare report of organic farming in nearer areas.
3. Submission of report.

References:

1. Sharma, Arun K. 2002. A Handbook of Organic farming. Agrobios, India.
2. Sathe, T.V. 2004, Vermiculture and Organic Farming. Daya Publishers.
3. Alvares, C. 1996. The Organic Farming Source Book. The Other India Press, Mapusa, Goa.
4. Gupta, M., 2004. Organic Agriculture Development in India. ABD publishers, Jaipur, India.

5. S.P. Palaniappan, K. Annadurai, 1999. Organic Farming- Theory and Practice, Scientific Publishers, Jodhpur, India.
6. Dr. PratikshaRaghuvanoki. Handbook of Organic Farming.
7. Organic Farming: The Ecological System- Agronomy Monograph 54, ASA, USA.
8. SubhaRao, N.S. 200, Soil Microbiology, Oxford & IBH Publishers, New Delhi
9. Dongarjal R. P. and Zade S.B. 2019. Insect Ecology and Integrated Pest Management, Akinik Publications, New Delhi.
10. Guideline of National Project on Organic Farming, Department of Agriculture and Cooperation, INM Division, Ministry of Agriculture, Govt. of India
11. DushyentGehlot. 2005. Organic Farming- standards, accreditation, certification and inspection. Agribios, India.
- 12 Fertilizer, W. P. 1975 Ed cereal seed Technology. Food and Agriculture Organisation of United Nation,. Rome.
- 13 Fertilizer, W. P. (1982), Ed Technical guidelines for maize seed technology. Food and Agriculture Organizatin of the United Nations, Rome
14. Kahate PM. 2019. Causes, effects and control measures of Eutrophication. In Book: Researchfrontiers in sciences, volume II, Bhumi Publication, Kolhapur, India.

Question Paper for Internal Practical

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXAMINATION B.Sc. I (Seed Technology), SEMESTER – I (NEP)				
Lab/Practical-3	Course	Code:	Organic Farming	Max Marks:
	131203			50
Question No.	Exercise			Marks
1	Perform any one exercise major (Any one)			10
2	Perform any one exercise minor (Any one)			10
3	Perform any one exercise on identification of deficiency symptoms (Any one)			10
4	Overall Performance throughout the semester			5
5	Record Book			5
6	Field visit report			5
7	Viva Voce			5
	Total			50

SEMESTER – II

Vertical	Type of Course	Course Code	Course Name
Major	Major/Minor Theory	131204	Seed production planning in plant breeding
Major	Lab/Practical 2	131205	Seed production planning and crop improvement
VSC	Lab/Practical-5	131206	Seed pathology
SEC	Lab/Practical-6	131207	Landscaping

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	131204	Seed Production planning in plant breeding	2	30	2 Hrs	30

Course Objectives:		1. To promote the possibility of self-employment 2. To enrich students training and knowledge that would be useful in seed industry so that the farmers will get quality seeds. 3. To introduce the concept of experimental design in seed technology. 4. To help students build up a progressive and successful career in industries with a Biotechnological perspective.		
Course Outcomes:		1. Demonstrate on understanding of seed and grain . 2. Acquire knowledge of quality seed and its cultivation 3. Develop critical thinking hybridization techniques and planning methods. 4. Acquire knowledge of multiplication of seeds etc. 5. Study of plant breeding techniques		
Unit System	Contents	Work load Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	1.1 General introduction—Seed definition-differences between seed and grain, Seed as a basic input in agriculture. 1.2 Role of high quality seeds in increasing and sustaining crop production 1.3 Seed quality concept, quality control in seed production. Characteristic of sowing quality seed. Mode of reproduction in relation to seed production 1.4 Classification of crop plant in relation to mode of reproduction and choice of methods for seed production	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1 Development and testing of varieties – System of breeding and testing of crop varieties and hybrids in self, often, and cross pollinated crops. 2.2 System of release and notification of varieties for general cultivation. 2.3 Varietal purity and its maintenance—Genetic purity of varieties-concept. Life span of varieties and factors responsible for their deterioration. 2.4 Methods of maintenance of genetic purity and techniques of maintenance breeding.	7	7	
Unit III	3.1 Improvement of pollination in seed production of forage legumes, tripping process and vegetables. Improvement of pollination for hybrid seed	8	8	

	production. 3.2 Hybrid seed production—Feasibility of hybrid seed production by the use of hand emasculation and pollination, supplementary pollination 3.3 Male sterility, gametocides and self-incompatibility. 3.4 Areas of seed production—Choice of area of seed production,			
Unit IV	4.1 Factors affecting the choice of area of seed production-soil type, climate, nutrition and weed status, insect pest and disease incidence. 4.2 Compact area approach in seed production. Seed village concept and Generation system of multiplication. 4.3 Generation system of seed multiplication. 4.4 System and methods of production of nucleus, breeder, foundation and certified seed.	7	7	

Practical List

1. Preparation of slides for the study of mitosis and meiosis.
2. Hybridization techniques
3. Identification of different crop seeds.
4. Study of inflorescence and flower structure of self and cross pollinated crops.
5. Identification of different crop seeds..
6. Study of pollination and fertilization, insect pollinators- their identification, management of insect pollinators especially honey bee isolation distance.
7. Study of seed production practices of cereals, pulses, oilseed, and fibre crops in relation to planting, weed control, roguing, harvesting and threshing.

Activities:

1. Photographic survey of seed growing fields of local area.
2. Field visits to sustainable Business Ventures for Cultivation of the Seed crops in Agricultural Institutes and Industries.
3. Visit of nucleus, breeder seed plots and study of maintenance of varieties.
4. Submission of field report.

References:

1. Agrawal R.L. Seed Technology Oxford IBH.
2. Choudhary R. C. 1982. Introduction to plant breeding Oxford and IBH, Publishing co., New Delhi.
3. Singh B. D. 1990, Plant breeding Principles and methods Kalyni publisher, New Delhi.
4. Simmonds N. W. 1979. Principles of crop improvement Longman, New-york.
5. Strickberger N W. 1985. Genetics, McMillan publishing co., New-york.
6. Gupta. P. K. 1991. Genetics Rastogi Publication co., Meerut.
7. Frankel R. and Galun E. 1977. Pollination mechanisms, Reproduction and plant Breeding, Springer-Verlag, Berlin.
8. Poehlman J. M. and Borthakur, D. 1972. Breeding Asian Field Crops. 121 122 Oxford and IBH publishing co., New Delhi.

9. Chopra V. L. Year plant breeding theory and practice. Oxford and IBH publishing co., NewDelhi.
10. Agrawal P. K. and DadlaniM. 1990. Techniques in seed science and Technology.South Asian publisher, New Delhi.
11. Kahate P.M., Gudadhe S., Zade R.V. andVerma S. 2023. Frontiers in Life Science Volume XI,First Edition, Bhumi Publishing, Kolhapur.

Question Paper for External Practical Course

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXAMINATION B.Sc. I (Seed Technology), SEMESTER – II (NEP)				
Lab/Practical-2	Course Code:	131204	Seed Production planning in plant breeding	Max Marks: 25
Question No.	Exercise			Marks
1	Perform Major Experiments (Any one)			10
2	Perform Minor Experiments (Any one)			5
4	Spotting			5
5	External Viva Voce			5
	Total			25

Assessment of Rubric for Internal Practical Course

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXAMINATION B.Sc. I (Seed Technology), SEMESTER – II (NEP)				
Lab/Practical-2	Course Code:	131205	Seed Production planning in plant breeding	Max Marks: 25
Question No.	Exercise			Marks
1	Record/ Assignment			5
2	Attendance			5
3	Participation in activity/Field visit report			5
4	Students Overall Performance throughout the semester			5
5	Internal Viva Voce			5
	Total			25

Semester II: Vocational Skill Course

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	131206	Seed Pathology	2	60	2 Hrs	30

Course Objectives:	1. To enrich students training and knowledge that would be useful in seed borne diseases. 2. To introduce the concept of seed pathogens like viral, bacterial and fungal and their entry into seed. 3. To help students to understand methodology to control seed borne pathogens useful them during their agricultural and industrial work.
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Course Outcomes:	1. Understand seed pathological diversity of the region. 2. Understand the major seed pathogens and their symptoms in the region. 3. Understand the need for development of safe control majors for seed pathogen. 4. Develop laboratory skills in testing of Seed pathogen.
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Unit System	Contents	Work load Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	History of seed pathology, mechanism of their growth and development, role of pathologist in understanding effect of pathogen and specific seeds, Mechanisms of point seed transmission. Entry of seed infection	8	8	Suitable pedagogical strategies are separately annexed
Unit II	Influence of environmental factors seed borne diseases Seed crop management, Economic significance of seed borne diseases.	7	7	
Unit III	Seed-borne fungi, bacteria, viruses and nematodes Storage fungi and its impact on animal and human health. Agricultural loss due to pathogens and their effect of farmers.	8	8	
Unit IV	Management of seed storage. Seed treatment, procedures and equipment quarantines of seed health testing's. Procedures of sampling for seed health testing.	7	7	

Activities: 1. Field visits to understand different pathogens, their biology, nature and loss in agricultural lands/ seed industries. 2. Mechanism of growth and development of seed. 3. Infected Seed collection from farmers field. 4. Differentiation of different seed borne pathogens. 5. Seed crop management. 6. Prepare and submit report

References:

1. Seed Pathology, Vol-I & II. P. Naergaard
2. Principals of seed Pathology, Vol-I & II. V.K. Agarwal & J.B. Sinclair
3. Seed Treatment. K.L. Jeffs.
4. Introductory Mycology. C.J. Alexopoulos
5. An introduction to fungi. J.P. Srivastava
6. Systemic fungicides R.W. Marsh
7. Fungicides in plant diseases control Y.L. Nene and P.N. Thapliyal
8. An annotated list of seed borne disease. Mary Noble and M.J. Richardson
9. Systemic fungicides. S.C. Vyas

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
PRACTICAL EXAMINATION
B.Sc. I (Seed Technology), SEMESTER – II (NEP)

Lab/Practical-3	Course Code: 131206	Seed Pathology	Max Marks: 50
Question No.	Exercise	Marks	
1	Perform any one exercise major (Any one)	15	
2	Perform any one exercise minor (Any one)	10	
3	Overall Performance throughout the semester	10	
4	Record Book	5	
5	Field visit report	5	
6	Viva Voce	5	
	Total	50	

Semester II: SEC

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	131207	Landscaping	2	30	2 Hrs	30

Course Objectives:	1. To enrich students training and knowledge that would be useful in landscaping. 2. To introduce the concept of experimental design in gardening. 3. To help students build up a progressive and successful career in industries with a Garden development
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Course Outcomes:	CO-1: Understand development, structure of landscaping CO-2: Analyse the developmental stages in the Garden development CO-3: Demonstrate various factors causing development and flourishing of plants in gardens.
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Unit System	Contents	Work load Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	Basics of landscaping in India and World, Landscaping : Definition, concept and importance, Future of Landscaping in major cities, factories and state and National Highways	8	8	Suitable pedagogical strategies are separately annexed
Unit II	Indian Gardens: History, Steps in preparation of gardening, Principles of landscaping garden viz., Axis, Rhythm, balance, time, space, texture, form, mass effect and Importance of Garden. Types and selection of plants for Garden: Trees, annuals, etc.	7	7	
Unit III	Lawn: definition, design and maintenance. Development of Institutional Gardens, planning and planting of avenues, beautifying educational Institutions, Factories, Airport, corporate buildings, religious places and temples	8	8	
Unit IV	Soil: Structure, fertility and Maintenance. Successful soil and water practices. Role of soil in gardening. Types of garden: Rock garden and Terrace Garden, Important Gardens of India and world, Royal Botanical Garden Kew, Kolkata, Bangalore Ootakmandalam (Ooty), Nagpur, etc.	7	7	

Practical's

1. To demonstrate Seed Germination
2. To study about potting and repotting.
3. To study about lawn establishment and maintenance.
4. To study care and maintenance of plants.
5. To study the identification of trees.
6. To study planning and planting of avenue trees for State and National Highways.

6. To study identification of pot plants.
7. To design about special type of garden i.e., Terrace garden / Rock garden/ Sunken garden
8. To design garden for Educational Institute or Factories.

Activities:

1. Visit and survey of various natural, forest and cities gardens.
2. Care and maintenance of plants.
3. Planning and planting of avenue trees for State and National Highways.
4. To design garden for Educational Institute or Factories
5. Germination of Seed in laboratory as well as in field.
6. Make report of gardens of our region.
7. Submission of reports.

References:

1. Text book of floriculture and landscaping, Anil K Singh, Anjana Sisodia
2. Objective Floriculture and Landscaping by Desh Raj
3. Introductory Ornamental Horticulture and landscape garden, Rajaneesh Singh and Bijendrakumar Singh
4. Floriculture in India, G S Randhava and A. Mukhopadhyaya
5. Floriculture, Landscaping and Turf Management by Alagarsamy Nithya Devi and Alagarsamy Ramesh Kumar
6. Floriculture and Landscaping –Vol.1 by Naya Udyog and T K Bose
8. Floriculture and Landscaping at a Glance by Laxmi Lal Somani
7. Text Book on Commercial Floriculture and Ornamental Horticulture with Landscape Architecture by Ashok Kumar and Abhinav Kumar
8. Laurie, Alex and Ries, Victor (2004). Floriculture- Fundamentals and Practices. Agrobios, (India), Jodhpur
9. The Books of Flowers Alice M. Coats, Chancellor Press, London.
10. Garden Flowers Joan Compton, Hamlyn publ. Gr. Ltd. London.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXAMINATION B.Sc. I (Seed Technology), SEMESTER – I (NEP)			
Lab/Practical-3	Course Code: 131207	Landscaping	Max Marks: 50
Question No.	Exercise	Marks	
1	Perform any one exercise major (Any one)	15	
2	Perform any one exercise minor (Any one)	10	
3	Overall Performance throughout the semester	10	
4	Record Book	5	
5	Field visit report	5	
6	Viva Voce	5	
	Total	50	

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI



THREE-YEAR UNDERGRADUATE PROGRAMME

Bachelor of Science (B.Sc.)

Subject: SEED TECHNOLOGY

FACULTY: SCIENCE AND TECHNOLOGY

**(Courses effective from Academic Year 2026-2027 Under
Uniform NEP 2020)**

Syllabus

Semester III and IV

B.Sc. II Sem III NEP Seed Tech Syllabus

Mode of Teaching	Vertical No	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/ Week)	Vertical Workload (Hrs/ Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major	MJ-Theory	131212	Hybrid Seed Production and Vegetable Seed Production	2	2	8
			MJ-Theory	131213	Foundation of Hybrid Vegetable Seed Production	2	2	
			MJ-Practical	131214	Experimental Hybrid and Vegetable Seed Production	2	4	
		IKS - SS	IKS-Theory	131215	Indian Seed Sector	2	2	
	b.	Minor	MN-Theory	131216	Seed Processing and Storage	2	2	4
			MN-Practical	131217	Experiments based on Seed Processing and Storage	2	4	
	c.	VSC	VSC-Practical	131218	Seed Genetics and Breeding	2	4	4
	d.	AEC - English	Theory		Refer University basket	1	1	2
		AEC – MIL	Theory		Refer University basket	1	1	
	e.	FP/CES	Project	131219	Separate SOP will be released	2	4	8
		CC	Outdoor		Field Project / Community Engagement Services in Botany: Phase-I	2	4	

Important:

- VSC Should be Complementary to Major
- SEC has to be selected from the Basket Provided by University, from the same Faculty/Discipline of the Major/Minor

B.Sc. II Sem IV NEP Seed Tech Syllabus

Mode of Teaching	Vertical No	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major	MJ-Theory	131220	Seed Testing and Seed Quality Control	2	2	8
			MJ-Theory	131221	Testing for Purity of Cultivars and Plant Variety Protection	2	2	
			MJ-Theory	131222	Seed Quality and Health Testing			
			MJ-Practical	131223	Experiments based on Testing of Seeds, Quality, Purity of Cultivars and Plant Variety Protection	2	4	
	b.	Minor	Mn-Theory	131224	Seed Testing and Quality	2	2	6
			Mn-Practical	131225	Experimental Testing and Quality of Seeds	2	4	
	c.	VSC	Practical	131226	Seed Production in Field Crops	2	4	8
		SEC	Practical	131227	Emerging Trends in Seed Quality Management	2	4	
	d.	AEC - English	Theory		Refer University basket	1	1	2
		AEC – MIL	Theory		Refer University basket	1	1	
	e.	FP/CES	Project	131228	Field Project / Community Engagement Services in Seed Technology: Phase-II	2	4	8
		CC	Outdoor		Separate SOP will be released	2	4	

Important:

- VSC Should be Complementary to Major
- SEC has to be selected from the Basket Provided by University, from the same Faculty/Discipline of the Major/Minor

B.Sc. II Sem III NEP Seed Tech Syllabus

Major Theory 131212: Hybrid Seed Production and Vegetable Seed Production

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After completion of this course successfully, the students would be able to

1. Understand different methods of reproduction of seeds.
2. Understand and easily differentiate methods of pollination in hybrid seeds plants; pollination control mechanism.
3. Understand the introduction of hybrid seeds in vegetable crops.
4. Apply methods for hybrid seed production in various crops and seed production lines.

Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Definition and History of heterosis and inbreeding depression. 1.2. Genetic, physiologic and Biochemical basis of heterosis. 1.3. Fixation of heterosis. 1.4. Exploitation of heterosis at commercial scale in Crops : Maize, Peral millet, Sorghum, Sunflower, Pigeonpea and Cotton.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Genetic male sterility and Cytoplasmic male sterility. 2.2. Concept and procedure of hybrid seed production and maintenance of seed parent – Pigeonpea, cotton and sunflower. 2.3. Advantages and dis-advantages of genetic male sterility. 2.4. Seed Production of CMS line 'A', Seed Production of maintainer line 'B' and Seed Production of restorer line 'R'.	7	7	
Unit III	3.1. Hybrid Seed Production in Different Crops. 3.2. Floral biology, seed production planning, Land and isolation requirement, wild pollinators, special agronomic practices, maintenance of varietal purity, field inspection, harvesting and threshing in the following crops- (1) Maize, (2) Pearl millet, (3) Sorghum, (4) Sun flower, (5) Pigeonpea, (6) Cotton. 3.3. Apomixes and its exploitation Hybrid Sorghum, Rice. 4.4. Pollination Control Mechanisms:	8	8	

	Flowering habit: Cucurbits, Asparagus, Spinach.			
Unit IV	4.1. Objectives of vegetative breeding and Reproduction. 4.2. Asexual reproduction, Vegetable propagation. 4.3. Sexual Reproduction- Male gamete formation, female gamete formation and fertilization. 4.4. Self- incompatibility. Gametophytic : in Lycopersicum sp and Solanum sp Sporophytic : Heteromorphic, Homomorphic.	7	7	

Major Theory 131213: Foundation of Hybrid Vegetable Seed Production

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedologies
Unit I	1.1. Hybrid Vegetable Seed Production : Aims and Objectives, content and future. 1.2. Introduction, Importance, Present and future Prospectus of vegetable seed production. 1.3. Asexual Reproduction , Sexual and Vegetative Propagation of seed plants.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Raising of crop, equipment required, emasculation and use of gametocide. 1.2 Pollination Methods in Vegetables – Hand Pollination, rubbing and hooking – use of electric bees. 1.3 Role of introduction and their utilization collection, maintenance, evaluation, storage.	7	7	
Unit III	3.1. Hybridization with reference to vegetable crops crosses between parents, single cross, double cross, back crops, triple cross. 3.2. Selection procedure in segregation progenies. Pedigree selection, Bulk method, single seed descent method. 3.3 Classification of vegetable crops. Root crops, Bulbous crops, leafy crops, flowering and fruit crops.	8	8	
Unit	4.1. Methods of seed production of the			

IV	under mentioned crops dealing with the aspect of – Land requirement, seedling/root production, planting cultural practices. 4.2. Breeding method used, plant protection, seed harvesting, drying, grading, seed extraction method of (i) Tropical Crops: Brinjal Potato, Chillies, Tomato. (ii) Root Crops :- Radish, Carrot, Colocacea. (iii) Leaf Vegetable –Spinach (Palak), Trigonella (Methi) (v) Bulb Crops – Onion. (vi) Temperate Vegetables : Cauliflower, cabbage.	7	7	

Distribution of Internal Marks = 20

Q.No.	Question	Marks
1.	Continuous Assessment Test (Best 1 out of 2 tests)	10
2.	Report of Seminar / Field visit/ Case study/ Any innovative method	10
	Total Internal Marks	20

Lab/Practical-7 (131214): Experiments based on Hybrid Seed Production and Vegetable Seed Production

S.N.	Content
1	Studies on inflorescence of some crop plants Cotton, Pearl-millet and Maize.
2	floral arrangement, floral morphology of some important crop plants Cotton, Pearl-millet and Maize.
3	Artificial emasculation and pollination studies in maize and cotton.
4	Studies on protogynous and protandous nature of flowers in Pearlmillet and Sunflower
5	Identification of vegetable seeds and Temperate vegetable.
6	Identification of Tropical vegetables and temperate-tropical vegetables.
7	Experiments on vegetable seed production. Collection of seeds, separation from pulp, drying etc
8	Study of Pollen grains of Vegetable: Collecton of pollen, germination of pollen grains in water, sugar solution, pollen gelly.
9	Visit to vegetable breeding farm.
10	Studies on synchronization problems in Pearlmillet, maize and Sunflower
11	Raising of nursery and planting; Nursery requirement and management for different vegetables.
12	Seedling age for transplanting, precautions, irrigation etc.
13	Floral Biology of Vegetables : Time for opening of flower, time for another maturity, Dehiscence of another hermaphrodite flower

14	Study of Pollen grains of Vegetable : Collecton of pollen, germination of pollen grains in water, sugar solution, pollen gelly
15	Selfing and Crossing techniques in vegetables, cucurbits, solanaceoeus crops, onion, carrot
16	Identification of vegetable seeds. Temperate vegetable, tropical vegetables, temperate-tropical vegetables
17	Visit to vegetable breeding farm. Experiments on vegetable seed production. Collection of seeds, separation from pulp, drying etc
Additional activities	1. Excursion (short/long) 2. Visit to any field area to study the plant diversity and seed growing area in natural habitat. The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic herbarium of seed growing plants. 2. Tour reports or field visit report

Course Material/Learning Resources Text books:

1. Principles of Plant Breeding field crops : R.W.Allard
2. Plant Breeding : B.D. Singh
3. Practices in Plant Breeding : M.M.Bhandari
4. Cytogenetics and Plant Breeding : Chandrasekharan and Parthasarathi
5. Male Sterility in higher Plants : M.L.H.Kaul.
6. Heterosis reappraisal theory and Practice : R.Frankel.
7. Sun flower Science and Technology : Jack F.Carter.
8. Seed Production Manual : N.S.C. and Rock feller Publication.
9. Seed Technology : R.L.Agrawal
10. Vegetable Breeding : Bassett M.J. (1986)
11. Vegetable Breeding : Kaloo R.P. (1985)

Question Paper for External Practical Course

Lab/Practical	Course Code	Experiments based on Hybrid Seed Production and Vegetable Seed Production	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Perform any one Major Experiment based on Floral Arrangement	05
2	Perform any one Major Experiment based on Pollination and its Practices	05
3	Perform any one Minor Experiment based on Identification of Vegetables	05
4	Spotting	05
5	External Viva Voce	05

Question Paper for Internal Practical Course

Lab/Practical	Course Code	Experiments based on Hybrid Seed Production and Vegetable Seed Production	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Record	05
2	Attendance	05
3	Participation in Any Activity	05
4	Overall Performance	05
5	External Viva Voce	05

IKS-Theory 131215 - Indian Seed Sector

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedologies
Unit I	1.1. Indian Seed Sector – Aim, Concept, Structure and Importance. 1.2. Policy Initiatives in Seed Sector – Seed Act 1966, National Commission on Agriculture’s Seed Group (1972). 1.3. Thrust areas and salient Feature of National Seeds Policy (2002) and Seed Bills. 1.4. Seed Hub	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Foundation and Breeders Seed. 2.2. Role of Public & Private Seed Sector, Variety Registration Procedures 2.3. Varietal protection in India- Concept and importance. 2.4. Public Private Sector Co-operation.	7	7	
Unit III	3.1. Seed Production system in India. 3.2. History, Objectives and Eligibility requirements of Seed Certification in India. 3.3. General Requirements, Phases and Seed Certification agencies in India. 3.4. Indian Seed Market.	8	8	
Unit IV	4.1. Seed Export Rules and Policies in India. 4.2. Seed Import Rules and Policies in India. 4.3. Present and Future of Indian Seed Improvement Programme . 4.4. Public and Private Sector Companies of Seed Breeding	7	7	

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks

2. Internal- 20 Marks

S.N.	Distribution of Internal Marks	Max. Marks. 20
1.	Continuous Assessment Test (Best 1 out of 2 tests)	10

2.	Submission of Project	05
3.	Field visit report	05

Course Material/Learning Resources Text books:

Agrawal, P.K. & M. Dadlani, 1995. Techniques In Seed Science And Technology (2nd Ed.) South Asian Publ. New Delhi.

Agrawal, R.L. 1997. Seed Technology (IInd Ed.) Oxford & IBH Publ. Co. Daryaganj, New Delhi. M.Sc. (Ag) Seed Science & Technology, HNBGU Page 13.

Jorben, J., Bharadwaj, C. SEED SCIENCE MADE EASY.

M. Prabhakar Rao. Indian Seed Industry Our Preparedness for AmritKaal.

Seed Production Manual : N.S.C. and Rock feller Publication.

<https://seednet.gov.in/material/Structure.htm>

<https://seednet.gov.in/Material/IndianSeedSector.htm>

Dr. Anubhav Kumar (Guest Faculty) Department of Seed Science and Technology (<https://csauk.ac.in/wp-content/uploads/2023/01/Indian-Seed-Industry-Dr.-Anubhav.pdf>)

Indian Agri Trends <https://www.ibef.org/exports/agriculture-and-food-industry-india>

NITI AAYOG- https://niti.gov.in/sites/default/files/2023-07/Aggricultrue_Amritkal.pdf

Minor Theory:

Theory 1: 131216 –Seed Processing and Storage

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Introduction: Principles and concept of seed processing. 1.2. Methods of seed drying including dehumidification and its impact on seed quality. 1.3. Relative humidity and equilibrium moisture content of seed;	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Seed cleaning equipment and their functions, 2.2. Preparing seed for processing; functions of scalper Debearder, Scarifier, huller, seed cleaner and grader. 2.3. Screen cleaners, specific gravity	7	7	

	separator, indented cylinder, velvet-spiral-disc separators, colour sorter, delinting machines; seed blending.			
Unit III	3.1. Seed treatments-methods of seed treatment. 3.2. Seed treating formulations and equipments; seed disinfestations. 3.3 Identification of treated seeds, Packaging. Principles, practices and materials, bagging and labeling.	8	8	
Unit IV	4.1. Seed drying and storage, drying methods-importance and factors affecting it, changes during storage, concepts and significance of moisture equilibrium. 4.2. Methods of maintaining safe seed moisture content, Methods to minimize the loss of seed vigour, viability factors influencing storage losses. 4.3. Storage methods, Godown sanitation and storage structures. Storage problems of recalcitrant seeds and their conservation.	7	7	

Course Material/Learning Resources Text books:

Agrawal, P.K. & M. Dadlani, 1995. Techniques In Seed Science And Technology (2nd Ed.) South Asian Publ. New Delhi.

Agrawal, R.L. 1997. Seed Technology (IInd Ed.) Oxford & IBH Publ. Co. Daryaganj, New Delhi. M.Sc. (Ag) Seed Science & Technology, HNBGU Page 13

Bailly, R. Gregg, Alvin, G. Law, S.S. Virde and Balis, J.S. Seed Processing. Cooperatively published by NSC, New Delhi and Mississippi State University and UNSAID.

Barton LV. 1985. Seed Preservation and Longevity. International Books and Periodicals Supply Service, New Delhi.

Chakravarty, A. Post Harvest Technology of Cereals, Pulses and Oil Seeds.

Copeland, R.A. 1996. Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis. VCH Publishers, New York.

Desai, B.B., Kotecha. P.M. and Salunkhe, D.K. 1997. Seeds Handbook. Marcel Decker Inc., New York

Justice, O.L. and Bass, L.N. 1978.Principles and practice of seed storage. USDA Agricultural Handbook no. 506, Washington. Castle House Pub. Ltd

Khare Dharendra & Bhale Mohan S. 2000. Seed Technology. Scientific Publ. India

Mc Donald, M.B. 1997. Seed Production: Principles and Practices.

Sahay KM & Singh K. K. 1991. Unit Operations in Food Engineering. Vikas Publ.

Simmonds, NW. 1979. Principles of Crop Improvement, Longman, London and New York.

Virdi SS & Gregg BG. 1970. Principles of Seed Processing. National Seed Corp., New Delhi.

Lab/ Practical 131217: Experiments based on Seed Processing and Storage

S.N.	Content
1	Operation and handling of mechanical drying equipment's.
2	Effect of drying temperature and duration on seed germination and storability with particular reference to oil seeds.
3	Seed extraction methods; seed processing equipment's
4	Seed treating Equipment's visit to seed processing plant and commercial controlled and uncontrolled Seed Stores
5	Seed quality up-gradation.
6	Measurement of processing efficiency.
7	Seed blending, bag closures.
8	Study of orthodox, intermediary and recalcitrant seeds.
Additional activities	1. Excursion (short/long) 2. Visit to any field area to study the Seed processing factories and seed Storing Godown in natural habitat. The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic submission seed processing equipments. 2. Tour reports or field visit report

Minor

Question Paper for External Practical Course

Lab/Practical	Course Code	Experiments based on Hybrid Vegetable Seed Production	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Perform any one Major Experiment based on Nursery Requirements and Managements for different Vegetables	05

2	Perform any one Major Experiment based on practices of pollen grains of vegetables	05
3	Perform any one Minor Experiment based on Identification of vegetables seeds	05
4	Spotting	05
5	External Viva Voce	05

Question Paper for Internal Practical Course

Lab/Practical	Course Code	Experiments based on Hybrid Vegetable Seed Production	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Record	05
2	Attendance	05
3	Participation in Any Activity	05
4	Overall Performance	05
5	External Viva Voce	05

VSC - Lab/ Practical's: 131218- Seed Genetics and Breeding

S.N.	Content
1	Genetical exercises based on Mendel's Law.
2	Field observation on flower opening and anthesis.
3	Hybridization techniques.
4	Field practice in emasculation and pollination.
5	Field practice of collection of pollen.
6	Study of Pollen viability and germination.
7	Problems based on Genetics.
Additional activities	1. Excursion (short/long) 2. Visit to any field area to study the Seed growing area in natural habitat. The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic submission of seed growing plants. 2. Tour reports or field visit report

Note: Mode of Examination: Internal (There is no External Examination)

Q.No.	Evaluation of Practical Marks	Total Marks 50
1	Overall Student attendance	10
2	Field observation on flower opening	10
3	Field practice of collection of pollen	10
4	Report submission of Flowers of seed crops	10
5	Visit Report	10

Course Material/Learning Resources Text books:

Allard, R.W. 1960. Principles of plant breeding. 2nd ed. John Wiley & Sons. New York. Book Society. CBS.

Chopra VL. 2004. Plant Breeding. Oxford & IBH.

Griffith et al. 2000. An introduction to genetic analysis, 7th ed. W.H. Freeman & Co.

Gupta SK. 2005. Practical Plant Breeding. Agribios.

Gupta, P.K. 1998. Genetics 3rd ed. Rastogi Publ. Shivaji Road Meerut, 250 002. M.Sc. (Ag) Seed Science & Technology, HNBGU Page 10

James R Wales 1981. Fundamentals of plant genetics and breeding. John Wiley & Sons, New York.

Kapoor, R.L. 1997. Plant Breeding and Crop Improvement. 2 Vols

Poehlman, J.M. And D. Borthakur 1969. Breeding Asian Field Crops. Oxford & IBH Publing Co. New Delhi.

Roy D. 2003. Plant Breeding, Analysis and Exploitation of Variation.

Sharma, J.R. 1996. Principles and Practice of Plant Breeding. Tata McGraw Hill Publ. Co. Ltd. New Delhi.

Singh, B.D. 2006. Plant Breeding Principles and Methods. Kalyani Publ. New Delhi

Snustad D. Peter; Simons, M.J. and Jenkins, J.B. 1999. Principles of genetics, 2nd ed. John Wiley & Sons, Inc., New York.

T. Ramanathan, Applied Genetics of Oilseed Crops, Daya Publishing house Delhi.

B.Sc. II Sem IV NEP Seed Tech Syllabus

Major Theory 1: 131220 - Seed Testing and Seed Quality Control

Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedologies
Unit I	1.1. Introduction, history and development of Seed Testing. 1.2. National and International Organisations and seed Testing linkages. 1.3. Seed testing laboratory layout and furnishing. 1.4. Seed testing equipment and their maintenance. Seed testing laboratory management and functioning	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Seed Sampling and Dividing. Heterogeneity test. 2.2. Handling and testing of the sample. Physical purity analysis. 2.3. Determination of other distinguishable varieties. 2.4. Moisture testing, germination testing – requirements, seedling evaluation and Various Types of Testing Methods like Rapid Test, Purity Test, Uniformity, etc.	7	7	
Unit III	3.1. Introduction to Seed Quality Control : Seed Quality, its concept, physical purity, germination, health and genetic purity. 3.2. Seed Quality Control Systems : Seed legislation, seed certification. Seed legislation. 3.3. Objectives – Indian Seed Act, seed rule and seed order. Seed Inspector Qualifications, duties and responsibilities. 3.4. Techniques of field inspection of seed production, plots of varieties and hybrids of cereals, pulses, oil seeds,	8	8	
Unit IV	4.1. Phases of seed certification. Seed Certification Agencies – its organisation. Seed Certification standards. 4.2. Composition and function of Central Seed Committee. Central sub-committee on crop standards, notification and release.. 4.3. Central seed certification board, state seed committee. Management of seed certification programme. 4.4. Organisation of Economic Cooperation and Development (OECD).	7	7	

Major Theory 2: 131221 - Testing for Purity of Cultivars and Plant Variety Protection

Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Objective of cultivar purity test, general principles and methods involved. 1.2. Use and limitations of laboratory, green house and field plot methods in determination of cultivars. 1.3. DNA finger printing and their use in varietal purity testing. 1.4. Registration of new varieties.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Chemical-biochemical tests for species and cultivar purity. 2.2. Phenol test, seed and seedling tests, electrophoretic analysis of seed protein. 2.3. Isozymes etc. use of chromatography for analysis of secondary compounds etc. 2.4. Use of computer-based varietal identification and purity testing.	7	7	
Unit III	3.1. Genesis of plant variety protection. 3.2. International Union for Protection of New Varieties of Plants and its functions. 3.3. Criteria for protection of new varieties of plants. 3.4. Principles and procedures of Distinctness, uniformity and Stability (DUS) testing.	8	8	
Unit IV	4.1. Test guidelines, planting material, duration and testing options. 4.2. Seed varieties of common knowledge. 4.3. Reference collection and grouping of varieties. 4.4. Types and categories of characters of variety protection.	7	7	

Major Theory 1: 131222 –Seed Quality and health Testing

Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Structure of monocot and dicot seeds 1.2.. seed quality : objectives, concept and components and their role. 1.3. seed quality control instruments, devices and tools used in seed testing 1.4. ISTA and its role in seed testing.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Seed Sampling: definition, objectives and Types of seed samples. 2.2. Sampling devices, procedure of seed sampling and sampling intensity. 2.3. Methods of preparing composite and submitted samples, sub-sampling techniques. 2.4. Dispatch, receipt and registration of submitted sample in the laboratory, sampling in the seed testing laboratory.	7	7	
Unit III	3.1. Viability and Vigour Testing: definition and importance of viability tests. 3.2. Different viability tests, quick viability test (TZ-test) – advantages and principle. 3.3. Preparation of seeds and solutions, evaluation and calculation of test results 3.4. Seed vigour testing concept, historical development, definitions, principles and procedures of different methods used for resting vigour.	8	8	
Unit IV	4.1. Seed health Testing: field and seed standards. 4.2. designated diseases, objectionable weeds – significance of seed borne disease vis-à-vis 4.3. Seed quality – seed health testing and detection methods for seed borne fungi, bacteria, viruses and nematodes. 4.4. Preparation and dispatch of seed testing reports; storage of guard samples; application and use of seed standards and tolerances.	7	7	

Distribution of Internal Marks = 20

Q.No.	Question	Marks
1.	Continuous Assessment Test (Best 1 out of 2 tests)	10
2.	Report of Seminar / Field visit/ Case study/ Any innovative method	10
	Total Internal Marks	20

Lab/ Practical: 131223 –**Experiments based on Testing of Seeds, Quality, Purity of Cultivars and Plant Variety Protection**

S.N.	Content
1	Obtaining working sample, making separation, weighing, identification of Purity components and reporting results.
2	Testing of germination substrata.
3	Determination of moisture holding capacity of sand.
4	Plotting the seeds for germination, seedling evaluation and reporting of results.
5	Handling of moisture meter.
6	Filling of application form for seed certification.
7	Exercise in field area measurement and field map preparation.
8	Checking of seed source, isolation requirements
9	Identification of objectionable weed plants and inseparable other crop plants.
10	Study of varietal purity through examination of seeds, seedling and plants, recording of data and filling result forms.
11	Chemical and biochemical tests for species and cultivar purity.
12	Phenol test, seed and seedling tests.
13	identification and handling of instruments used in seed testing laboratory
14	estimation of seed moisture content (oven method).
15	: seed dormancy breaking methods requirements for conducting germination test,
16	seed health testing for designated diseases, blotter methods, agar method and embryo count methods;
17	viability testing by tetrazolium test in different crops
18	Determination of physical purity and genetic purity.
19	Morphological description of Seed parts and plant.
20	Seed character expression and states.
21	Recording observation and interpretation of data.
Additi onal activiti es	1. Excursion (short/long) 2. Visit to any field area to study the plant diversity and seed growing area in natural habitat. The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submis sion	1. Photographic herbarium of seed growing plants. 2. Tour reports or field visit report

Course Material/Learning Resources Text books:

1. Seed Technology: R.L.Agrawal
2. Seed Biolog : K.K.Kozlowski
3. Seed Production Manual: National Seed Corporation and Rocke feller publication.
4. Techniques in seed science and technology: P.K.Agrawal and M.Dadlani. 65 66
5. A Handbook of Seed Inspectors: Central Seed Committee Ministry of Agriculture.
6. Indian Minimum Seed Certification Standards: N.S.Tunwar, S.V.Singh.
7. Principles of Seed Certification and Testing: N.P.Nem

Question Paper for External Practical Course

Lab/Practical	Course Code	Experiments based on Testing of Seeds, Quality, Purity of Cultivars and Plant Variety Protection	Max. Marks 25	Time : 04.00 Hrs

Q. No.	Exercise	Marks
1	Perform any one Major Experiment based on Seed Testing	05
2	Perform any one Major Experiment based on Seed Quality Control	05
3	Perform any one Minor Experiment based on Seed Testing and Quality Control	05
4	Spotting	05
5	External Viva Voce	05

Question Paper for Internal Practical Course

Lab/Practical	Course Code	Experiments based on Testing of Seeds, Quality, Purity of Cultivars and Plant Variety Protection	Max. Marks 25	Time : 04.00 Hrs

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Q. No.	Exercise	Marks
1	Record	05
2	Attendance	05
3	Participation in Any Activity	05
4	Overall Performance	05
5	External Viva Voce	05

Minor Theory: 131224 - Seed Testing and Quality

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Introduction, history and development of Seed Testing. 1.2. Seed testing laboratory layout and furnishing. Seed testing equipment and their maintenance. 1.3. Seed testing laboratory management and functioning. 1.4. Handling and testing of the sample.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Rapid test, Seed vigour testing, Culture purity testing., Testing of plated seeds and Uniformity in seed. 2.2. Record keeping and reporting of results. Storage of guard samples. 2.3. Seed testing in relation to seed act and marketing. 2.4. New seed policy (1988) provisional seed certification.	7	7	
Unit III	3.1. Characters. Seed Quality Control Systems: Seed legislation, seed certification. Seed legislation. 3.2 Objectives – Indian Seed Act, seed rule and seed order. 3.3. Seed Inspector Qualifications, duties and responsibilities. 3.4. Concept and history, classes of seed and phases of seed certification, Seed Certification Agencies.	8	8	

Unit IV	4.1. Inspection at harvesting, threshing, processing. Sampling for seed quality evaluation. Issue of certificates and tag, sealing for forage and fibre crops, potato and vegetables. 4.2. Testing of genetic purity of seed in grow out test particularly of cotton. 4.3 Seed Quality Control Organization India - Composition and function of Central Seed Committee. Central sub-committee on crop standards, notification and release. 4.4. Organisation of Economic Cooperation and Development (OECD).	7	7	

Lab/Practical : 131225-Experimental Testing and Quality of Seeds

S.N.	Content
1	Testing of germination substrata and determination of moisture holding capacity of sand.
2	Plotting the seeds for germination, seedling evaluation and reporting of the results.
3	Tetrazolium testing of agricultural, vegetable and forestry seeds.
4	Moisture testing by oven drying method.
5	Determination of relative efficacy of Moisture meter.
6	Exercise in field area measurement and field map preparation
7	Observation in field inspection
8	Study of varietal purity through examination of seeds, seedling and plants, recording of data and filling result forms.
Additional activities	1. Excursion (short/long) 2. Visit to any field area to study the plant diversity and seed growing area in natural habitat. The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic herbarium of seed growing plants. 2. Tour reports or field visit report

Course Material/Learning Resources Text books:

1. Seed Technology : R.L.Agrawal
2. Seed Biology : K.K.Kozlowski

3. Seed Production Manual : National Seed Corporation and Rocke feller publication.
4. Techniques in seed science and technology : P.K.Agrawal and M.Dadlani. 65 66
5. A Handbook of Seed Inspectors : Central Seed Committee Ministry of Agriculture.
6. Indian Minimum Seed Certification Standards : N.S.Tunwar, S.V.Singh.
7. Principles of Seed Certification and Testing : N.P.Nem

Question Paper for **Minor** External Practical Course

Lab/Practical	Course Code	Experimental Testing and Quality of Seeds	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Perform any one Major Experiment based on Seed Testing	05
2	Perform any one Major Experiment based on Seed Quality Control	05
3	Perform any one Minor Experiment based on Seed Testing and Quality Control	05
4	Spotting	05
5	External Viva Voce	05

Question Paper for Minor Internal Practical Course

Lab/Practical	Course Code	Experimental Testing and Quality of Seeds	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Record	05
2	Attendance	05
3	Participation in Any Activity	05
4	Overall Performance	05
5	External Viva Voce	05

VSC Lab/Practical : 131226 – Seed Production in Field Crops

S.N.	Content
1	Planning of Seed Production.
2	Requirements for different classes of seeds in field crops - unit area and rate.
3	Seed production in cross pollinated crops with special reference to land and isolation requirements.
4	Planting ratio of male and female lines.
5	Synchronization of parental lines and methods to achieve synchrony.
6	Supplementary pollination, pollen storage, hand emasculation and pollination in Cotton.
7	Identification of rogues and pollen shedders of Corn.
8	Pollen collection, storage, viability and stigma receptivity in Sorghum and Barley.
9	Gametocide application
10	Visits to seed production plots etc.
Additional activities	1. Excursion (short/long) 2. Visit to any field area to study the Seed Production in Field. The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic herbarium of seed growing plants. 2. Tour reports or field visit report

Note: Mode of Examination: Internal (There is no External Examination)

Q.No.	Evaluation of Practical Marks	Total Marks 50
1	Preparation of Planning of Seed Production Model	10
2	Preparation of specimens of different seeds from field area	10
3	Collection of Pollen of different crops from syllabus	10
4	Report submission of pollination of crops	10
5	Submission of case study of seed collection and production in field crops	10

SEC Lab/Practical 131227- Emerging Trends in Seed Quality Management

S.N.	Content
1	Seed treatments – methods and techniques.
2	Equipment required for seed treatment.
3	Film coating, seed invigoration/priming - hydration and dehydration.
4	PEG priming, solid matrix priming, bio priming, effects of priming.
5	Methods for hydrogel encapsulation of artificial endosperm.
6	Hydrophobic coating etc.
7	Protocols for production of synthetic seeds.
8	Visit to leading Seed Companies to study the seed treatment processes.
Additional activities	1. Excursion (short/long) 2. Visit to any field area to study the Seed Treatment Institutes and Industry The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic Submission of Seed Treatment Equipment and Processes. 2. Tour reports or field visit report

Note: Mode of Examination: Internal (There is no External Examination)

Q.No.	Evaluation of Practical Marks	Total Marks 50
1	Preparation of Planning of Seed Quality Management	10
2	Study of any one Equipment required for seed treatment.	10
3	Study of hydrogel encapsulation of artificial endosperm	10
4	Submission of case study of Seed Quality Management in Industry.	10
5	Visit Report of leading Seed Companies to study the seed treatment processes	10

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI



THREE-YEAR UNDERGRADUATE PROGRAMME

Bachelor of Science (B.Sc.)

Subject: SEED TECHNOLOGY

FACULTY: SCIENCE AND TECHNOLOGY

**(Courses effective from Academic Year 2026-2027 Under
Uniform NEP 2020)**

Syllabus

Semester V and VI

B.Sc. III Sem V NEP Seed Tech Syllabus

Mode of Teaching	Vertical No	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/ Week)	Vertical Workload (Hrs/ Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major	Major - T	131230	Seed Crop Management	2	2	12
			Major - T	131231	Pollination and Breeding Methods in Vegetable crops	2	2	
			Major - T	131232	Pest of field crops, stored grains, Quarantine and their management	2	2	
			Major - P	131233	Management of Seed pathology and entomology	2	4	
	b.		Major Elective T1	131234	Principles of Integrated pest management	2	2	
			Major Elective P1	131235	Practical based on IPM	2	4	
	c.	Minor	Minor - T	131236	Seed Health and Farm Management	2	2	6
			Minor - P	131237	Practical's based on Seed health management	2	4	
	d.	VSC	VSC - P	131238	Abiotic stress Management in Vegetable seed crops	2	4	4
	e.	SEC -	SEC - P	131239	Germplasm Collection, Exchange and quarantine	2	4	4
	g.	FP/CES	Project	131240	Seed Technology Lab(FP/CES in Seed Technology)	2	4	8
		CC	Outdoor			2	4	
		Non Credit	Non Credit		Foundation of Artificial Intelligence	NC	2	

Important:

- VSC Should be Complementary to Major
- SEC has to be selected from the Basket Provided by University, from the same Faculty/Discipline of the Major/Minor

B.Sc. III Sem VI NEP Seed Tech Syllabus

Mode of Teaching	Vertical No	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major	Major - T	131241	Seed Processing	2	2	
			Major - T	131242	Seed Farm Management	2	2	
			Major - T	131243	Seed Industries and Marketing	2	4	
			Major - P	131244	Practical based on seed processing and farm management	2	4	
	b.		Major Elective T1	131245	Seed Marketing, Management and Statistic	2	4	
			Major Elective P1	131246	Laboratory practical's based on Seed Marketing, Management and Statistic	2	4	
	c.	Minor	Minor -T	131247	Seed farm management and marketing	2	2	
			Minor - P	131248	Experiments based on farm management and marketing	2	4	
	d.	VSC	VSC-P	131249	Seed Tissue Culture	2	4	
	e.	Internship Apprenticeship		131250	OJT (On the Job Training)	2	4	
		CC	Outdoor		Separate SOP will be released	2	4	

Important:

- VSC Should be Complementary to Major

B.Sc. III Sem V NEP Seed Tech Syllabus

Major Theory 131230: Seed Processing

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After completion of this course successfully, the students would be able to

1. Understand different methods of reproduction of seeds.
2. Understand and easily differentiate methods of pollination in hybrid seeds plants; pollination control mechanism.
3. Understand the introduction of hybrid seeds in vegetable crops.
4. Apply methods for hybrid seed production in various crops and seed production lines.

Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Definition and History of heterosis and inbreeding depression. 1.2. Genetic, physiologic and Biochemical basis of heterosis. 1.3. Fixation of heterosis. 1.4. Exploitation of heterosis at commercial scale in Crops : Maize, Peral millet, Sorghum, Sunflower, Pigeonpea and Cotton.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Genetic male sterility and Cytoplasmic male sterility. 2.2. Concept and procedure of hybrid seed production and maintenance of seed parent – Pigeonpea, cotton and sunflower. 2.3. Advantages and dis-advantages of genetic male sterility. 2.4. Seed Production of CMS line 'A', Seed Production of maintainer line 'B' and Seed Production of restorer line 'R'.	7	7	
Unit III	3.1. Hybrid Seed Production in Different Crops. 3.2. Floral biology, seed production planning, Land and isolation requirement, wild pollinators, special agronomic practices, maintenance of varietal purity, field inspection, harvesting and threshing in the following crops- (1) Maize, (2) Pearl millet, (3) Sorghum, (4) Sun flower, (5) Pigeonpea, (6) Cotton. 3.3. Apomixes and its exploitation Hybrid Sorghum, Rice. 3.4. Pollination Control Mechanisms: Flowering habit: Cucurbits, Asparagus, Spinach.	8	8	

Unit IV	4.1. Objectives of vegetative breeding and Reproduction. 4.2. Asexual reproduction, Vegetable propagation. 4.3. Sexual Reproduction- Male gamete formation, female gamete formation and fertilization. 4.4. Self- incompatibility. Gametophytic : in Lycoperscicum sp and Solanum sp Sporophytic : Heteromorphic, Homomorphic.	7	7	
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Major Theory 131231: Pollination and Breeding Methods in Vegetable crops

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Hybrid Vegetable Seed Production : Aims and Objectives, content and future. 1.2. Introduction, Importance, Present and future Prospectus of vegetable seed production. 1.3. Asexual Reproduction, Sexual and Vegetative Propagation of seed plants.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Raising of crop, equipment required, emasculation and use of gametocide. 2.2 Pollination Methods in Vegetables – Hand Pollination, rubbing and hooking – use of electric bees. 2.3 Role of introduction and their utilization collection, maintenance, evaluation, storage.	7	7	
Unit III	3.1. Hybridization with reference to vegetable crops crosses between parents, single cross, double cross, back crops, triple cross. 3.2. Selection procedure in segregation progenies. Pedigree selection, Bulk method, single seed descent method. 3.3 Classification of vegetable crops. Root crops, Bulbous crops, leafy crops, flowering and fruit crops.	8	8	
Unit IV	4.1. Methods of seed production of the under mentioned crops dealing with the aspect of – Land requirement, seedling/root production, planting cultural practices. 4.2. Breeding method used, plant protection, seed harvesting, drying, grading, seed extraction method of	7	7	

	(i) Tropical Crops: Brinjal Potato, Chillies, Tomato. (ii) Root Crops :- Radish, Carrot, Colocacea. (iii) Leaf Vegetable –Spinach (Palak), Trigonella (Methi) (v) Bulb Crops – Onion. (vi) Temperate Vegetables : Cauliflower, cabbage.			

Distribution of Internal Marks = 20

Q.No.	Question	Marks
1.	Continuous Assessment Test (Best 1 out of 2 tests)	10
2.	Report of Seminar / Field visit/ Case study/ Any innovative method	10
	Total Internal Marks	20

Major Theory 131232: Pest of field crops, stored grains, Quarantine and their management

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Insect pests of cereals and millets and their management. 1.2. Grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non-insect pests (mites, birds, rodents, snails, slugs and mammalian etc.). 1.3. Microorganisms and their elimination; Symptomatic diagnosis and other techniques to detect pest/pathogen infestations.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Insect pests of pulses, tobacco, oilseeds and their management. 2.2 Insect pests of fibre crops, forages, sugarcane and their management. 2.3 Pests of stored grains and their management	7	7	
Unit III	3.1. Quarantine – domestic and international. Quarantine restrictions in the movement of agricultural produce, seeds and planting material. 3.2. Identification of pest/disease free areas; contamination of food with toxigens. 3.3 History of quarantine legislations, PQ Order 2003. Environmental Acts, Industrial	8	8	

	registration			
Unit IV	4.1. WTO regulations; non-tariff barriers; Pest risk analysis, good laboratory practices for pesticide laboratories; 4.2. Pesticide industry; Sanitary and Phytosanitary measures.. 4.3. Transmission of plant viruses by beetles and mites. Epidemiology and management of insect transmitted diseases through vector management	7	7	

Distribution of Internal Marks = 20

Q.No.	Question	Marks
1.	Continuous Assessment Test (Best 1 out of 2 tests)	10
2.	Report of Seminar / Field visit/ Case study/ Any innovative method	10
	Total Internal Marks	20

Lab/Practical-7 (131233): Management of Seed pathology and entomology

S.N.	Content
1	Demonstration and handling of stereobinocular microscope.
2	Symptoms of important seed borne pathogens.
3	Visual examination of dry seeds for disease symptoms.
4	Examination of suspensions obtained from washings of seeds.
5	Viability test-space germination test and tetrazolium test.
6	Detection of important seed-borne bacteria-various methods.
7	Detection of important seed borne viruses various-methods.
8	External morphology of insect, type of mouth parts, antenna and legs.
9	Identification of important storage pests, stages of insects.
10	Detection of seed borne insects and estimation of infestation.
11	Plant protection equipments, their safe handling and use.
12	Handling of bees for pollination.
13	Collection and submission of stored product pests visit to ware houses and godowns.
14	Detection and estimation of infestation and losses in different crops and stored grain.
15	Study of life history of important insect pests.
16	
17	Visit to vegetable breeding farm. Experiments on vegetable seed production. Collection of seeds, separation from pulp, drying etc
Additional activities	1. Excursion (short/long) 2. Visit to any field area to study the plant diversity and seed growing area in natural habitat.

	The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic herbarium of seed growing plants. 2. Tour reports or field visit report

Course Material/Learning Resources Text books:

A.S. Atwal. Agricultural Entomology.

Atwal AS, Dhaliwal GS & David BV. 2001. Elements of Economic Entomology. Popular Book Depot, Chennai.

B.D. Singh. Plant Breeding.

Bassett M.J. 1986. Vegetable Breeding.

Chandrasekharan and Parthasarathi. Cytogenetics and Plant Breeding.

Dhaliwal GS, Singh R & Chhillar BS. 2006. Essentials of Agricultural Entomology. Kalyani Publ., New Delhi.

Dunston AP. 2007. The Insects: Beneficial and Harmful Aspects. Kalyani Publ., New Delhi

Evans JW. 2005. Insect Pests and their Control. Asiatic Publ., New Delhi.

J.B. Free. Insect Pollination of field crops.

Jack F. Carter. Sun flower Science and Technology.

K.L. Jeffs. Seed Treatment.

Kaloo R.P. 1985. Vegetable Breeding.

M.L.H. Kaul. Male Sterility in higher Plants.

M.M. Bhandari. Practices in Plant Breeding.

Nair MRGK. 1986. Insect and Mites of Crops in India. ICAR, New Delhi.

O.S. Bindra. Plant Protection Equipments.

Prakash I & Mathur RP. 1987. Management of Rodent Pests. ICAR, New Delhi.

R. Frankel. Heterosis reappraisal theory and Practice.

R.L. Agrawal. Seed Technology.

R.W. Allard. Principles of Plant Breeding field crops.

Saxena RC & Srivastava RC. 2007. Entomology at a Glance. Agrotech Publ. Academy, Udaipur.

Seed Production Manual: N.S.C. and Rock feller Publication.

V.K. Agarwal & J.B. Sinclair. Principles of Seed Pathology Vol-I & II.

Question Paper for External Practical Course

Lab/Practical	Course Code	Experiments based on Hybrid Seed Production and Vegetable Seed Production	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Perform any one Major Experiment based on Floral Arrangement	05
2	Perform any one Major Experiment based on Pollination and its Practices	05
3	Perform any one Minor Experiment based on Identification of Vegetables	05
4	Spotting	05
5	External Viva Voce	05

Question Paper for Internal Practical Course

Lab/Practical	Course Code	Experiments based on Hybrid Seed Production and Vegetable Seed Production	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Record	05
2	Attendance	05
3	Participation in Any Activity	05
4	Overall Performance	05
5	External Viva Voce	05

Major Elective-Theory 131234 – Principles of Integrated pest management

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. History and origin, definition and concept of Integrated pest management 1.2. Evolution of various related terminologies. 1.3. Importance of resistance, principles, classification, components, types and mechanisms of resistance.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Concept and philosophy, ecological principles, economic threshold concept, and economic consideration. 2.2. Insect-host plant relationships; theories. 2.3. Basis of host plant selection in phytophagous insects.	7	7	
Unit III	3.1. Tools of pest management and their integration. 3.2. Legislative, cultural, physical and mechanical methods. 3.3. Pest survey, surveillance, forecasting, types of surveys including remote sensing methods	8	8	
Unit IV	4.1. factors affecting surveys; political, social and legal implications of IPM 4.2. Pest risk analysis; pesticide risk analysis; cost-benefit ratios. 4.3. Partial budgeting; case studies of successful IPM programmes.	7	7	

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

S.N.	Distribution of Internal Marks	Max. Marks. 20
1.	Continuous Assessment Test (Best 1 out of 2 tests)	10
2.	Submission of Project	05
3.	Field visit report	05

Lab/Practical-7 (131235): Practical based on Integrated pest management

S.N.	Content
1	Characterization of agro-ecosystems
2	Population estimation methods
3	Sampling methods and factors affecting sampling
4	Crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses
5	Crop modeling; designing and implementing IPM system
6	Screening techniques
7	Breeding for insect resistance in crop plants
8	Exploitation of wild plant species
9	Gene transfer and successful examples of resistant crop varieties in India and world.
Additional activities	1. Excursion (short/long) The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination

Question Paper for External Practical Course

Lab/Practical	Course Code	Practical based on Integrated pest management	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Perform any one Population estimation methods	05
2	Perform any one sampling methods	05
3	Perform any one Experiment based on Crop modeling; designing and implementing IPM system	05
4	Spotting	05
5	External Viva Voce	05

Question Paper for Internal Practical Course

Lab/Practical	Course Code	Practical based on Integrated pest management	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Record	05
2	Attendance	05
3	Participation in Any Activity	05
4	Overall Performance	05
5	Internal Viva Voce	05

Course Material/Learning Resources Text books:

Agrawal, P.K. & M. Dadlani, 1995. Techniques In Seed Science And Technology (2nd Ed.) South Asian Publ. New Delhi.

Agrawal, R.L. 1997. Seed Technology (IIInd Ed.) Oxford & IBH Publ. Co. Daryaganj, New Delhi. M.Sc. (Ag) Seed Science & Technology, HNBGU Page 13.

Dhaliwal GS & Arora R. 2003. Integrated Pest Management – Concepts and Approaches. Kalyani Publ., New Delhi.

Dr. Anubhav Kumar (Guest Faculty) Department of Seed Science and Technology (<https://csauk.ac.in/wp-content/uploads/2023/01/Indian-Seed-Industry-Dr.-Anubhav.pdf>)

Flint MC & Bosch RV. 1981. Introduction to Integrated Pest Management. 1st Ed., Springer, New York.

Horowitz AR & Ishaaya I. 2004. Insect Pest Management: Field and Protected Crops. Springer, New Delhi.

<https://seednet.gov.in/Material/IndianSeedSector.htm>

<https://seednet.gov.in/material/Structure.htm>

Ignacimuthu SS & Jayaraj S. 2007. Biotechnology and Insect Pest Management. Elite Publ., New Delhi.

Indian Agri Trends <https://www.ibef.org/exports/agriculture-and-food-industry-india>

Jorben, J., Bharadwaj, C. SEED SCIENCE MADE EASY.

M. Prabhakar Rao. Indian Seed Industry Our Preparedness for AmritKaal.

Metcalf RL & Luckman WH. 1982. Introduction of Insect Pest Management. John Wiley & Sons, New York.

NITI AAYOG- https://niti.gov.in/sites/default/files/2023-07/Aggricultrue_Amritkal.pdf

Norris RF, Caswell-Chen EP & Kogan M. 2002. Concepts in Integrated Pest Management. Prentice Hall, New Delhi.

Pedigo RL. 2002. Entomology and Pest Management. 4th Ed. Prentice Hall, New Delhi.

Seed Production Manual : N.S.C. and Rock feller Publication.

Subramanyam B & Hagstrum DW. 1995. Integrated Management of Insects in Stored Products. Marcel Dekker, New York.

Minor Theory:

Theory: 131236–Seed Health and Farm Management

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Introduction and importance of seed pathology; Brief account of seed borne fungi, bacteria, viruses and nematodes 1.2. Mechanism of seed infection and transmission of seed pathogens. 1.3. Important seed borne diseases caused by Bacteria, Fungi, Viruses and Nematodes. Influence of environmental factors on seed borne diseases. 1.4 Methods of controlling seed borne diseases (cultural, physical and chemical). Role of bio-pesticides for control of seed borne diseases.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Introduction to seed Entomology; Losses caused by insect damage and its economic implications. 2.2. Insect herbivory, their nature of damage and management of following crops: Maize – Army worm, Pea – Pea pod borer. 2.3. Study of insect and nature of damage of some store grain pests. Methods of insect pest control (cultural, mechanical, physical and chemical). 2.4. Seed quarantine- concept, objectives and procedure. Seed Quarantine set up in India.	7	7	
Unit III	3.1. Different production practices/field practices as tillage, irrigation, sowing, transplanting, harvesting and threshing. Concepts of crop rotation. 3.2. Mixed cropping, multiple cropping and dry land farming. 3.3 Scope and basic principles of Seed Farm Management.	8	8	

Unit IV	4.1. Maintenance of soil fertility. Manures and fertilizers, Different types of fertilizers used in crops. 4.2. farmyard manure, compost, green manures, vermi-compost and biofertilizers. 4.3. Weeds- Different type of weeds, classification of weeds. Weed management..	7	7	
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Course Material/Learning Resources Text books:

Agrawal, P.K. & M. Dadlani, 1995. Techniques In Seed Science And Technology (2nd Ed.) South Asian Publ. New Delhi.

Agrawal, R.L. 1997. Seed Technology (IInd Ed.) Oxford & IBH Publ. Co. Daryaganj, New Delhi. M.Sc. (Ag) Seed Science & Technology, HNBGU Page 13

Bailly, R. Gregg, Alvin, G. Law, S.S. Virde and Balis, J.S. Seed Processing. Cooperatively published by NSC, New Delhi and Mississippi State University and UNSAID.

Barton LV. 1985. Seed Preservation and Longevity. International Books and Periodicals Supply Service, New Delhi.

Bilal Ahmad Wani (2021) Seed Technology and Management” Kushal Publishers

Boca Raton. Neergaard P. 1988. Seed Pathology. Mac Millan.

Chakravarty, A. Post Harvest Technology of Cereals, Pulses and Oil Seeds.

Copeland, R.A. 1996. Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis. VCH Publishers, New York.

Desai, B.B., Kotecha. P.M. and Salunkhe, D.K. 1997. Seeds Handbook. Marcel Decker Inc., New York

Justice, O.L. and Bass, L.N. 1978.Principles and practice of seed storage. USDA Agricultural Handbook no. 506, Washington. Castle House Pub. Ltd

Karuna V. 2007. Seed Health Testing. Kalyani.

Karuna vishunavat (2009) Fundamentals of seed pathology.

Khare Dhirendra & Bhale Mohan S. 2000. Seed Technology. Scientific Publ. India

Mc Donald, M.B. 1997. Seed Production: Principles and Practices.

Reddy SR. 2000. Principles of Crop Production. Kalyani.

Sahay KM & Singh K. K. 1991. Unit Operations in Food Engineering. Vikas Publ.

Simmonds, NW. 1979. Principles of Crop Improvement, Longman, London and New York.

Virdi SS & Gregg BG. 1970. Principles of Seed Processing. National Seed Corp., New Delhi.

Agarwal VK & Sinclair JB. 1997. Principles of Seed Pathology.

Lab/ Practical 131237: Experiments based on Seed Processing and Storage

S.N.	Content
1	Detection of fungal/bacterial pathogens of some common crop seeds by visual/stereoscopic microscopic examinations and or washing techniques.
2	Detection of seed borne fungi of some common crops (Maize, Paddy, wheat) by any incubation method.
3	Collection and identification of insects (Grass hopper, Rice weevil, Kharpa beetle).
4	Plant protection equipments- their operation and maintenance.
5	To study the morphology and mouth parts of grasshopper, leaf minor, Rice weevil, Kharpa beetle.
6	To study the garden soil characteristics (pH, bulk density, water holding capacity).
7	To study some common weeds of crop plants and crop seed nurseries.
8	Description and chemical formula of some recommended seed fungicides and insecticides using charts/photographs.
Additional activities	1. Excursion (short/long) 2. Visit to any field area to study the Seed pathogens and Insects, plant protection equipment's. The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic submission Seed pathogens 2. Tour reports or field visit report

Question Paper for External Practical Course

Lab/Practical	Course Code	Experiments based on Hybrid Vegetable Seed Production	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Study of detection of fungal/bacterial pathogens of some common crop seeds by microscopic examination.	05
2	Perform any one Major Experiment based on the morphology and mouth parts of grasshopper, leaf minor, Rice weevil, Kharpa beetle.	05
3	To study the garden soil characteristics (pH, bulk density, water holding capacity).	05
4	Spotting	05
5	External Viva Voce	05

Question Paper for Internal Practical Course

Lab/Practical	Course Code	Experiments based on Hybrid Vegetable Seed Production	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Record	05
2	Attendance	05
3	Participation in Any Activity	05
4	Overall Performance	05
5	Internal Viva Voce	05

VSC - Lab/ Practical's: 131238- Abiotic stress Management in Vegetable seed crops

S.N.	Content
1	Identification of susceptibility and tolerance symptoms to various types of stress in vegetable crops.
2	Measurement of tolerance to various stresses in vegetable crops.
3	Short term experiments on growing vegetable under water deficit.
4	Experiment based on water-logging and salinity.
5	Experiments based on high and low temperature conditions.
6	Experiment based on use of chemicals for alleviation of different stresses.
7	Determination of water use efficiency as a drought resistant trait
8	Estimation of ABA content in leaf and root tissues under stress
9	Determination of Sodium and Potassium in plant tissue grown under salt stress
Additional activities	1. Visit to any field area to study the Seed growing area to study seed crops.
Submission	1. Tour reports or field visit report

Note: Mode of Examination: Internal (There is no External Examination)

Q.No.	Evaluation of Practical Marks	Total Marks 50
1	Overall Student attendance	10
2	Field observation on susceptibility and tolerance symptoms of seed crops.	10
3	Experiment based of water-logging and salinity.	10
4	Report submission of effect of various stresses on seed crops.	10
5	Visit Report	10

Course Material/Learning Resources Text books:

Agrawal, P.K. & M. Dadlani, 1995. Techniques In Seed Science And Technology (2nd Ed.) South Asian Publ. New Delhi.

Agrawal, R.L. 1997. Seed Technology (IInd Ed.) Oxford & IBH Publ. Co. Daryaganj, New Delhi. M.Sc. (Ag) Seed Science & Technology, HNBGU

Dwivedi P & Dwivedi RS. 2005. Physiology of Abiotic stress in Plants. Agrobios.

Hand book of Agriculture, Indian Council of Agricultural Research, Krishi Bhavan, New Delhi.

Lerner HR (Ed.). 1999. Plant Responses to Environmental Stresses.

Marcel Decker. Maloo SR. 2003. Abiotic Stresses and Crop productivity. Agrotech Publ. Academy.

Pereira A. 2016. Plant Abiotic Stress Challenges from the Changing Environment. Front. Plant Sci. 7: 1123.

Rout GR and Das AB. 2013. Molecular Stress physiology of plants. Springer, India.

Sergey Shabala, 2012. Plant Stress Physiology.

SEC - Lab/ Practical's: 131239- Germplasm Collection, Exchange and Quarantine

S.N.	Content
1	Plant exploration and collection.
2	Techniques of coarse and fine grid surveys.
3	Identification of wild relatives of crop plants- Example of collection, cataloguing and preservation of specimens.
4	Sampling techniques of plant materials; Visiting seed Godowns and market to study the quarantine regulations.
5	Techniques for the detection of insects, mites, nematodes, bacteria, weeds, pathogens and viruses on seed and planting materials and salvaging.
6	Use of visual, qualitative, quantitative, microscopic, molecular and plant related techniques (controlled greenhouses/growth chambers, etc).
7	Study of post-entry quarantine operation, seed treatment and other prophylactic treatments.
Additional activities	1. Excursion (short/long) 2. Visit to forest and field area to wild relatives of crop plants in natural habitat. The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic submission of wild seed plants. 2. Tour reports or field visit report

Note: Mode of Examination: Internal (There is no External Examination)

Q.No.	Evaluation of Practical Marks	Total Marks 50
1	Overall Student attendance	10
2	Field observation on quarantine operation and seed treatment	10
3	Field practice of collection, cataloguing and preservation of specimens.	10
4	Report submission of field visits of seed Godowns and Markets to study the quarantine regulations.	10
5	Internal viva	10

Course Material/Learning Resources Text books:

Briggs D. 1997. Plant Variation and Evolution. Science Publ.

Cronquist AJ. 1981. An Integrated System of Classification of Flowering Plants. Columbia Univ. Press.

Dhillon BS, Varaprasad KS, Kalyani S, Singh M, Archak S, Srivastava U & Sharma GD. 2001. Germplasm Conservation A Compendium of Achievements. NBPGR, New Delhi.

di Castri F & Younes T. 1996. Biodiversity Science and Development: Towards New Partnership. CABI & International Union for Biol. Sci. France.

Gurcharan Singh. 2004. Plant Systematics: An Integrated Approach. Science Publ. Lawrence GMH. (Ed.). 1951. Taxonomy of Vascular Plants. London.

Paroda RS & Arora RK. 1991. Plant Genetic Resources Conservation and Management Concepts and Approaches. IPGRI Regional office for South and South Asia, New Delhi.

Pearson LC. 1995. The Diversity and Evolution of Plants. CRC Press.

Singh BP. 1993. Principles and Procedures of Exchange of Plant Genetic Resources Conservation and Management. Indo-US PGR Project Management.

Sivarajan VV. 1991. Introduction of Principles of Plant Taxonomy. Science Publ. Stace CA. Plant Taxonomy and Biosystematics 2nd Ed. Cambridge Univ. Press.

Takhrayan A. 1997. Diversity and Classification of Flowering Plants. Columbia Univ. Press.

Wiersema JH. 1999. World Economic Plants: A Standard Reference. Blanca Leon.

B.Sc. III Sem VI NEP Seed Tech Syllabus

Major Theory 1: 131241 - Seed Processing and Seed Treatment

Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Definition, concept and theory of Seed drying, 1.2. Importance and advantage of seed drainage 1.3. Moisture content recalcitrant orthodox-seeds. 1.4. Methods of seed moisture measurement.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Definition, concept and objectives of specific gravity separators of seed. 2.2. Adjustment of intended disc and intended seed separator. 2.3. The roll mill, parts of the machine, Separating action and the adjustments, cleaning roll mills.	7	7	
Unit III	3.1. Concept and importance of Seed treatment equipment's. 3.2. Mechanism and control of slurry treater. 3.3. Parts, construction and operation of mist-o-matic seed treater. 3.4. Maintenance and repair of seed processing equipment.	8	8	
Unit IV	4.1. Layout of machines in a seed processing plant for efficient production and main movement. 4.2. Machine operation, and seed user's safety. 4.3. Labeling of treated seeds and related precautions. 4.4. Storage and importance of treated seeds.	7	7	

Major Theory 2: 131242 – Seed packaging and Farm Management

Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedologies
Unit I	1.1 Site selection for seed processing plant on a seed production farm. 1.2. Mechanical inquiry of seeds in post-harvest phase, conservation of energy and production in seed processing, 1.3. Seed conveyors and elevators, bucket elevators belt conveyors screen conveyors. 1.4. Difference between a specific gravity separators, oscillating conveyors and bucket elevator.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Computing the required height of bucket elevators and capacity determination of bucket elevators. 2.2. Concept, operation and importance of oscillation conveyors. 2.3. Definition, concept, objectives and importance of Packaging of seeds. 2.4. Concept and Mechanism of Bager weigher, bag closing and labeling.	7	7	
Unit III	3.1. Maintaining lot identity, lot numbers, seed pellets, handling and stacking. 3.2. Maintenance of seed processing records. 3.3. Seed storage structures: construction, operation and maintenance. 3.4. Insulation, storage, air conditioning and dehumidification during seed storage.	8	8	
Unit IV	4.3. Stacking, moisture and heat proofing of seed storage structures, seed storage management. 4.2. Field of farm management, scope, basic principles, decision making, operation and control in farm management. 4.3. Decision making based on production, cost and capital investment. 4.4. Cost analysis, law of diminishing return, and profitable combination of input and output.	7	7	

Major Theory 3: 131243 –Farm business and Marketing

Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Planning and management of crops. Building and machinery Important crops of India. 1.2. Concepts pertaining to various crop production operations viz tillage, irrigation, sowing plant protection, harvesting and threshing. 1.3. Maintenance of soil fertility, weeds and their control	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Mixed cropping, multiple cropping and dry land farming. 2.2. Machinery selection and their management determination of field capacity and field efficiency, machinery adjustments. 2.3. Consideration in farm buildings implement shed, storage structures.	7	7	
Unit III	3.1. Farm business analysis, Farm size, factors affecting profit and economic size of farm,. 3.2. Budget and Record Keeping: Farm budgeting, procedure and use. 3.3. Farm efficiency measures, farm records and their use. 3.4. Acquisition and Management of Land labour and Capital Farm.	8	8	
Unit IV	4.1. Surveys, data collection and analysis of Marketing. Basic concepts, supply and demand price equilibrium in marketing. 4.2. Seed transportation, storage cost and returns, cost of processing and packaging. 4.3. Market organization for seed marketing; Structure and working of seed markets in India. 4.4. Seed market surveys, projections of supply and demand for different kinds of seed in India-Seed pricing of Breeder/Foundation/ Certified Seeds.	7	7	

Distribution of Internal Marks = 20

Q.No.	Question	Marks
1.	Continuous Assessment Test (Best 1 out of 2 tests)	10
2.	Report of Seminar / Field visit/ Case study/ Any innovative method	10
	Total Internal Marks	20

Lab/ Practical: 131244 – Practical based on seed processing and farm management

S.N.	Content
1	Study of physical characteristics of different crop seeds and their shapes.
2	Determination of physical properties of seeds of different crops
3	Measurement of seed moisture content by direct and indirect methods
4	Study of air screen cleaner cum grader
5	Study of specific gravity separator
6	Study of seed packaging equipment.
7	Study of seed treatment machines
8	Study of bucket elevator, screw conveyors and pneumatic elevators.
9	Identification of farm machines and their use.
10	Determination of field capacity and field efficiency.
11	Soil sampling fertility and moisture content.
12	Calibration and adjustment of various farm machines.
13	Cost analysis.
14	Farm planning and Budgeting.
15	Record Keeping.
16	Case study in any one seed marketing industry.
Additional activities	1. Excursion (short/long) 2. Visit to a seed processing and storage complex and familiarization with different machines.
Submission	1. Case study 2. Tour reports or field visit report

Course Material/Learning Resources Text books:

1. Seed Technology : R.L.Agrawal
2. Hand book of Agriculture, Indian Council of Agricultural Research, Krishi Bhavan, New Delhi.
3. Farm Power and Machinery Management, Vth edition, 10WA State, U.S.A. Hunt, D, 1968.
4. Farm Management Decision, Operation Control. John E Kadlec, Prentice Hall, Inc Englewood, Cliffs, New jersey, U.S.A.
5. Fundamentals of farm Management S.S. Joshi and T.R. Kapur, Kalyani Publishers, India, Ludhiana.
6. Fundamentals of farm Management A.S. Kahlon and Karam Singh, Kalyani Awed Publishers PVT.Ltd. 13/14 Asaf Ali Road New delhi/ Madras/Bombay/Calcutta/Bangalore.
7. Economics of farm Production and Management, V.T. Raju and DVS Rao, IBH Publishing Co Pvt.Ltd. New Delhi.
8. Agricultural Marketing in India, S.S. Achary Oxford and I.B.H., New Delhi.

Major

Question Paper for External Practical Course

Lab/Practical	Course Code 131244	Practical based on seed processing and farm management	Max. Marks 25	Time : 04.00 Hrs

Q. No.	Exercise	Marks
1	Determination of physical properties of seeds of different crops	05
2	Identification of farm machine and their use	05
3	Study of operations of seed treatment equipment	05
4	Experiment based on cost analysis, Farm planning, Budgeting and Record keeping	05
5	External Viva Voce	05

Question Paper for Internal Practical Course

Lab/Practical	Course Code 131244	Practical based on seed processing and farm management	Max. Marks 25	Time : 04.00 Hrs

Q. No.	Exercise	Marks
1	Record	05
2	Attendance	05
3	Participation in Any Activity	05
4	Overall Performance	05
5	External Viva Voce	05

Major Elective-Theory 131245 – Seed Marketing, Management and Statistic

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Importance and promotion of quality seed, formal and informal seed supply systems. 1.2. Basic concepts of marketing with special reference to seed. 1.3. Importance and scope of seed industry in India, major constraints/problems in seed industry. 1.4. Role of seed sector and seed association in seed trade.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Problems of marketing in demand and supply sales promotion, distribution channels. 2.2. Seed marketing intelligence and product mix, sales promotion, distribution channels, 2.3.. Demand and supply of seed; Role of seed replacement rate (SRR), seed multiplication ratio (SMR), cost of production and returns determining seed needs; 2.4. Seed pricing and price policy, seed processing and /packaging, demand forecasting.	7	7	
Unit III	3.1 . Marketing corporation. Marketing costs and margins. 3.2. Market research and market information services 3.3. Seed marketing intelligence and product Mix. 3.4. Salient features of National Seed Policies, role of various sectors/agencies in efficient seed marketing, quality control and assurance programme.	8	8	

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

S.N.	Distribution of Internal Marks	Max. Marks. 20
1.	Continuous Assessment Test (Best 1 out of 2 tests)	10
2.	Submission of Project	05
3.	Field visit report	05

Major Elective Practical 131246: Laboratory practical's based on Seed Marketing, Management and Statistic

S.N.	Content
1	Statutory requirements in seed business including R&D.
2	Estimation of cost of seed production.
3	Marketing costs and margins of seeds of different crops.
4	Measures of Central Tendencies
5	Measures of Dispersion
6	Chi square test for goodness of fit.
7	General procedures of seed certification.
8	Case studies to compare public & private sectors in different conditions, impact analysis, seed pricing, cost benefit ratio, economic feasibility of seed industry etc.
Additional activities	1. Excursion (short/long) 2. Visit to any seed marketing agencies to identify problems and solutions of marketing field.
Submission	1. Tour reports or field visit report

Question Paper for External Practical Course

Lab/Practical	Course Code 131246	Laboratory practical's based on Seed Marketing, Management and Statistic	Max. Marks 25	Time : 04.00 Hrs
Q. No.	Exercise			Marks
1	Perform any one experiment based on cost of seed production			05
2	Perform any one experiment based on statistic			05
3	Perform any one seed certification.			05
4	Spotting			05
5	External Viva Voce			05

Question Paper for Internal Practical Course

Lab/Practical		Course Code 131246	Laboratory based control mechanism of seed crop pest and weeds.	Max. Marks 25	Time : 04.00 Hrs
Q. No.	Exercise				Marks
1	Record				05
2	Attendance				05
3	Participation in case study				05
4	Overall Performance				05
5	Internal Viva Voce				05

Suggested Readings

Acharya, S.S. Agricultural marketing in India, Oxford and IBH., New Delhi.

Agarwal VK & Sinclair JB. 1997. Principles of Seed Pathology. Boca Ratan.

John, E. Kadlec, Farm management, Decision, operation, control. Prentice Hall, Inc. Englewood, Chiffs, New Jersey, U.S.A.

Kahlon, A.S. and Singh Karan. Economics of farm management in India, Allied Publishers Pvt. Ltd., 13/14, Asaf Ali Road, New Delhi M.Sc. (Ag) Seed Science & Technology, HNBGU
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Karuna V. 2007. Seed Health Testing. Kalyani.

Kohls RL & UHI JN. 1980. Marketing of Agricultural Products. MacMillan.

Kundu KK & Suhag KS. 2006. Teaching Manual on Seed Marketing and Management. Department of Agricultural Economics, CCS HAU, Hisar.

Micheal, D. Boehlje and Verman, R. Ediman. Farm Management. Kalyani Publishers.

Miller, B. McDonald and Lawrence O. Copeland, 1998. Seed Production: Principles and Practices. CBS publishers and distributors, 11 Darya ganj, New Delhi.

Raju, V.T and Rao, DVS. Economics of farm production and management, IBH Publishing Comp. Pvt. Ltd., New Delhi.

Venugopal P.2004. State of Indian Farmers: A Millenmium Study. Vo. VIII. Input Management. Academic Foundation, Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi.

Vigneshwara Varmudy 2001. Marketing of vegetables in India.

Minor Theory: 131247 – Seed Farm Management and Marketing

Unit	Content	Workload Allotted (Hrs)	Weightage of Marks Alloted	Incorporation of Pedologies
Unit I	1.1. Introduction, history and development of seed farm management. 1.2. Decision making based on production, cost and capital investment. 1.3. Cost analysis law of diminishing return, opportunity cost. 1.4. Profitable combination of input and output.	8	8	Suitable pedagogical strategies are separately annexed
Unit II	2.1. Important crops of India and concepts of various crop production operations viz tillage, irrigation, sowing plant protection. 2.2. Maintenance of soil fertility, weeds and their control. 2.3. Mixed cropping, multiple cropping and dry land farming. 2.4. Mechanism of Harvesting and threshing.	7	7	
Unit III	3.1. Machinery selection and their management. 3.2. Determination of field capacity and field efficiency, machinery adjustments. 3.3. Consideration in farm buildings implements; shed and storage structures. 3.4. Farm business analysis, Farm size, factors affecting profit and economic size of farm.	8	8	
Unit IV	4.1. Farm budgeting, procedure and use, Farm efficiency measures, farm records and their use. 4.2. Farm survey, Acquisition and Management of land labour. 4.3 Concepts, supply and demand price of seed transportation. 4.4. Marketing organization for seed marketing and seed markets in India.	7	7	

Lab/Practical: 131248-Experiments based on farm management and marketing

S.N.	Content
1	Study of physical characteristics of different crop seeds and their shapes
2	Determination of physical properties of seeds of different crops
3	Identification of farm machines and their use
4	Determination of field capacity and field efficiency
5	Soil sampling fertility and moisture content
6	Calibration and adjustment of various farm machines
7	Cost analysis.
8	Farm planning and Budgeting
9	Record Keeping
Additional activities	1. Excursion (short/long) 2. Visit to any seed farm The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic herbarium of seed growing plants. 2. Tour reports or field visit report

Question Paper for **Minor** External Practical Course

Lab/Practical	Course Code	Experimental Testing and Quality of Seeds	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Perform any one Major Experiment based on physical characteristics of different crop seeds and their shapes.	05
2	Perform any one Major Experiment based on farm machines.	05
3	Perform any one Minor Experiment based on Soil sampling fertility and moisture content.	05
4	Spotting.	05
5	External Viva Voce.	05

Question Paper for Minor Internal Practical Course

Lab/Practical	Course Code	Experimental Testing and Quality of Seeds	Max. Marks 25	Time : 04.00 Hrs
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Q. No.	Exercise	Marks
1	Record	05
2	Attendance	05
3	Participation in Any Activity	05
4	Overall Performance	05
5	External Viva Voce	05

Course Material/Learning Resources Text books:

Acharya, S.S. Agricultural marketing in India, Oxford and IBH., New Delhi.

B.P. Ghildyal and R.P. Gupta, 2002. Soil Structure: problems and Management, ICAR, New Delhi.

Hunt, D. 1968. Farm Power and Machinery Management, Vth edition, IOWA State, U.S.A.

ISTA (1983). Seed Technology in the tropics. The International Seed Testing Association, reprinted by Scientific Publishers, India.

John, E. Kadlec, Farm management, Decision, operation, control. Prentice Hall, Inc.

Englewood, Chiffs, New Jersey, U.S.A.

K.K.Kozlowski. Seed Biology.

Kahlon, A.S. and Singh Karan. Economics of farm management in India, Allied Publishers Pvt. Ltd., 13/14, Asaf Ali Road, New Delhi.

Kundu KK & Suhag KS. 2006. Teaching Manual on Seed Marketing and Management.

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Micheal, D. Boehlje and Verman, R. Ediman. Farm Management. Kalyani Publishers.

Miller, B. McDonald and Lawrence O. Copeland, 1998. Seed Production: Principles and Practices. CBS publishers and distributors, 11 Darya ganj, New Delhi.

N.P.Nem. Principles of Seed Certification and Testing.

N.S.Tunwar, S.V.Singh. Indian Minimum Seed Certification Standards.

P.K.Agrawal and M.Dadlani. Techniques in seed science and technology,65-66.

R.L.Agrawal. Seed Technology:

Raju, V.T and Rao, DVS. Economics of farm production and management, IBH Publishing Comp. Pvt. Ltd., New Delhi.

Seed Production Manual: National Seed Corporation and Rockefeller publication.

Venugopal P. 2004. State of Indian Farmers: A Millennium Study. Vol. VIII. Input Management. Academic Foundation, Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi.

Vigneshwara Varmudy 2001. Marketing of vegetables in India.

VSC Lab/Practical : 131249– Seed Tissue Culture

S.N.	Content
1	Preparation of stocks - macronutrients, micronutrients, vitamins and hormones, filter, sterilization of hormones and antibiotics.
2	Preparation of Murashige and Skoog medium.
3	Micro-propagation of seed plants by nodal and shoot tip culture.
4	Embryo culture to overcome incompatibility,
5	Anther culture for haploid production.
6	Callus induction in tobacco leaf discs, regeneration of shoots, root induction, role of hormones in morphogenesis.
7	Acclimatization of tissue culture plants and establishment in greenhouse.
8	Virus indexing in tissue culture plants.
9	Plan of a commercial tissue culture UNIT
10	Visits to seed production plots etc.
Additional activities	1. Excursion (short/long) 2. Visit to any tissue culture unit.
Submission	1. Tour reports or field visit report

Note: Mode of Examination: Internal (There is no External Examination)

Q.No.	Evaluation of Practical Marks	Total Marks 50
1	Demonstration of any one Major experiment	10
2	Demonstration of any one Minor experiment	10
3	Demonstration of anther and callus culture	10
4	Spotting	10
5	Viva voce	10

Course Material/Learning Resources Text books:

Razdan, M. K. (2003) Introduction to plant tissue culture, 2nd edition, Oxford publications group.

Butenko, R. G. (2000) Plant Cell Culture University Press of Pacific.

Herman, E. B., (2008) Media and Techniques for Growth, Regeneration and Storage, Agritech Publications, New York, USA.

Bhojwani, S.S and Dantu, P. 2013. Plant Tissue Culture – An Introductory Text. Springer Publications.

Gamborg, O.L and G.C.Philips (eds.). 2013. Plant Cell, Tissue and Organ culture Lab Manual. Springer Science & Business media.