

Syllabus Prescribed for Three Year UG Programme

Programme : B.Sc.

Semester III

Code of the Course/Subject Title of the Course/Subject (Total Number of periods) SDT(1S) / S 72

Hybrid Seed Production and Vegetable Seed Production

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

Floral biology and artificial pollination mechanisms in rice and maize. Three line, two line and one line system for hybrid seed production in rice and different types of hybrid seed production techniques in maize.

Current status of hybrids in India and future prospects of hybrids.

	Unit	Content
Unit I	Introduction : Definition of heterosis and inbreeding depression and brief history of the development of these concepts. Genetic, physiologic and Biochemical basis of heterosis. Exploitation of heterosis at commercial scale in Crops : Maize, Peral millet, Sorghum, Sunflower, Pigeonpea and Cotton. Fixation of heterosis – an approach. Apomixes and its exploitation Hybrid Sorghum, Rice.	12
Unit II	Devices for Hybrid Seed Production : Genetic male sterility and hybrid seed production. Advantages and disadvantages of genetic male sterility. Role of marker genes linked with genetic male sterility. Procedure of hybrid seed production and maintenance of seed parent – Pigeonpea, cotton and sunflower. Cytoplasmic and Genetic male sterity. Introduction to the system. Synchronisation methods of achievement. Seed Production of CMS line 'A'. Seed Production of maintainer line 'B'. Seed Production of restorer line 'R'	12
Unit III	Hybrid Seed Production in Different Crops : 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) Pearlmillet, (3) Sorghum, (4) Sun flower, (5) Pigeonpea, (6) Cotton, (7) Hybrid Rice, (8) Hybrid Mustard, (9) Safflower. Economics of hybrid seed production. Seed Planning..	12
Unit IV	History and Objectives of Vegetable Breeding : History of vegetable crop improvement. Objectives of vegetative breeding. Reproduction, pollination control mechanisms. A – Asexual reproduction. - Vegetable propagation - Apomixis - Artificial seeds. B - Sexual Reproduction Male gamete formation, female gamete formation, fertilization. C. Pollination Control Mechanisms : a) Flowering habit : Cucurbits, Asparagus, Spinach. b) Self incompatibility Gametophytic : in <i>Lycoperscicum</i> sp and <i>Solanum</i> sp Sporophytic : Heteromorphic, Homomorphic c) Male Sterility Genetic male sterility in tomato, brinjal and muskmelon	12
Unit V	Hybridization Techniques in Vegetables. Raising of crop, equipment required, emasculation and use of gametocide. Pollination Methods in Vegetables – Hand Pollination, rubbing and hooking – use of electric bees. Breeding Methods in Vegetables – 1. Role of introduction and their utilization collection, maintenance, evaluation, storage. 2. Selection : a) Pureline selection – Definition, method, achievements. b) Single Plant Selection – Procedure, achievements. c) Clonal Selection – Collection of clones, testing of clones, achievements. 3. Hybridization with reference to vegetable crops crosses between parents, single cross, double cross, back crops, triple cross. Selection procedure in segregation progenies. Pedigree selection, Bulk method, pure line family method (PLF), single seed descent method	12

Unit VI	<p>Vegetables Seed Production : Introduction, importance, present status and future prospectus. Classification of vegetable crops. Root crops, Bulbous crops, leafy crops, flowering and fruit crops. Methods of seed production of the under mentioned crops dealing with the aspect of – Land requirement, seedling/root production, nursery management, planting cultural practices. Breeding method used, plant protection, seed harvesting vegetable cum seed production, drying, grading, seed extraction method, wet-dry methods.</p> <p>a) Tropical Crops :- Solanaceous : Brinjal, Potato, Chillies, Tomato. Root Crops :- Radish, Carrot, Colocacea. Leaf Vegetable –Spinach (Palak), Trigonella (Methi) etc. Bulb Crops – Onion etc.</p> <p>b) Temperate Vegetables : Cauliflower, cabbage.</p>	12
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	<p>SEM (Skill Enhancement Module)</p> <p>1 Study the Seeds of local crop plants 1.1 Study of hybrid seeds 1.2 Cultivation and seed production of hybrid seed (anyTwo)</p> <p>OR</p> <p>2 Study Devises of hybrid seed production 2.1 Floral Biology 2.2 Vegetable breeding</p>	
	<p>COs:- After completion of skill enhancement module learner will be able to It is well known that in general hybrids are more vigorous than conventional varieties. This means they are more able to compensate in the field under difficult growing conditions. 25% yield advantage has been reported with hybrids. A hybrid crop is a result of two different varieties of plants, are cross-pollinated to create an offspring or hybrid that contains the best traits of each of the parents. In hybridization, pollination is carefully controlled to ensure that the right plants are crossed to achieve the desired combination of characteristics, such as bigger size or better disease resistance. The process of developing a hybrid typically requires many years.</p>	
	<p>** Activities</p> <ol style="list-style-type: none"> 1. Collection of seed and fruits of local agricultural crops 2. Conduct mechanical seeds germination experiments on local crop plants. 3. Visit seed storage and study seed deterioration 4. Visit local crop fields and study pollination in local crops 	

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 Cytogenetics and Plant Breeding : Chandrasekharan and Parthasarathi
4. Male Sterility in higher Plants : M.L.H.Kaul.
5. Heterosis reappraisal theory and Practice : R.Frankel.
6. Sun flower Science and Technology : Jack F.Carter.
7. Seed Production manual : N.S.C. and Rock feller Publication.
8. Seed Technology : R.L.Agrawal

9. Vegetable Breeding : Bassett M.J. (1986)
10. Vegetable Breeding : Kaloo R.P. (1985)

**Syllabus Prescribed for Three Year UG Programme:
B.Sc. Semester III**

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/handson/Activity)	(No. of Periods/Week)
SDT(3S)/Seed Technology	Practical	2

By the end of the Lab/Practical Course, generally students would be able to:

- 1) Understand forms of morphology of different types of seeds
- 2) Acquire the skill of preparation of various types of test
- 3) Study of seed germination and moisture content
- 4) Acquire knowledge of slide preparation of mitotic study.

*** List of Practical/Laboratory Experiments/Activities etc.**

S.N.	
Hybrid Seed Production :	
1	Studies on inflorescence, floral arrangement floral morphology of some important crop plants cotton, pigeonpea, pearl millet, and maize
2	Artificial emasculation and pollination studies in maize and cotton.
3	Studies on protogynous and protandous nature of flowers in Pearlmillet and Sunflower.
4	Studies on synchronisation problems in Pearlmillet, maize and Sunflower
Vegetable Seed Production :	
5	Raising of nursery and plantin. Nursery requirement and management for different vegetables. Seedling age for transplanting, precautions, irrigation etc.
6	Floral Biology of Vegetables : Time for opening of flower, time for another maturity, Dehiscence of another hermaphrodite flower.
7	Study of Pollen grains of Vegetable : Collecton of pollen, germination of pollen grains in water, sugar solution, pollen gelly.
8	Selfing and Crossing techniques in vegetables, cucurbits, solanaceous crops, onion, carrot.
9	Identification of vegetable seeds. Temperate vegetable, tropical vegetables, temperate-tropical vegetables.
10	Visit to vegetable breeding farm. Experiments on vegetable seed production. Collection of seeds, separation from pulp, drying etc
Addi tiona l activi ties	1. Excursion (short/long) 2. Visit to any field area to study the plant diversity and seed growing area innatural habitat. The excursion is compulsory for all students and the report of excursions should be submitted at the time of practical examination
Submi ssion	1. Photographic herbarium of seed growing plants. 2. Tour reports or field visit report

Faculty: Science and Technology

Programme: B.Sc (Seed Technology)

Syllabus Prescribed for Three Year UG/PG Programme: B.Sc

Semester- IV

Code of the Course/Subject	Title of the Course/Subject	(No. of Periods/Week)
SDT(4S)/ SEED TECHNOLOGY	Seed Testing and Seed Quality Control	60

COs

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

1. Demonstrate on understanding of seed Testing.
2. Acquire knowledge of seed cultivation practices and testing techniques
3. Develop a eye towards the seed quality testing

	Unit	Content
Unit I	Introduction, history and development of Seed Testing. National and International Organisations and seed Testing linkages. Seed testing laboratory layout and furnishing. Seed testing equipment and their maintenance. Seed testing laboratory management and functioning. Seed Sampling and Dividing. Heterogeneity test. Handling and testing of the sample. Physical purity analysis. Determination of other distinguishable varieties. Moisture testing, germination testing – requirements, seedling evaluation.	12
Unit II	Rapid test for seed quality determination. Seed vigour testing. Culture purity testing. Testing of plated seeds. Uniformity in seed testing results and use of tolerances. Record keeping and reporting of results. Storage of guard samples. Seed testing in relation to seed act and marketing.	12

Unit III	Introduction to Seed Quality Control : Seed Quality, its concept, physical purity, germination, health and genetic purity Concept of variety variation – heritable and non-heritable characters. Seed Quality Control Systems : Seed legislation, seed certification. Seed legislation. Objectives – Indian Seed Act, seed rule and seed order. Seed Inspector Qualifications, duties and responsibilities. Unit-V : Techniques of field inspection of seed production, plots of varieties and hybrids of cereals, pulses, oil seeds, forage and fibre crops, potato and vegetables. Inspection at harvesting, threshing, processing. Sampling for seed quality evaluation. Issue of certificates and tag, sealing. Testing of genetic purity of seed in grow out test. Particularly of cotton. Revalidation of seed lots. Interstate seed certification. New seed policy (1988) provisional seed certification.	12
Unit IV	Seed Certification : Concept and history, classes of seed and phases of seed certification. Phases of seed certification. Seed Certification Agencies – its organisation. Seed Certification standards. Land requirements and isolation distance. Principles of field inspection.	12
Unit V	Techniques of field inspection of seed production, plots of varieties and hybrids of cereals, pulses, oil seeds, forage and fibre crops, potato and vegetables. Inspection at harvesting, threshing, processing. Sampling for seed quality evaluation. Issue of certificates and tag, sealing. Testing of genetic purity of seed in grow out test. Particularly of cotton. Revalidation of seed lots. Interstate seed certification. New seed policy (1988) provisional seed certification	12
Unit VI	Seed Quality Control Organization India : Composition and function of Central Seed Committee. Central sub-committee on crop standards, notification and release. Central seed certification board, state seed committee. Management of seed certification programme. Seed Certification Internationally. Organisation of Economic Cooperation and Development (OECD) Seed Certification Schemes. Future trends in seed certification. Plant Variety Protection – Plant Breeders Right.	12

	SEM (Skill Enhancement Module) 1 Plant breeding in local plants 1.1 Techniques of field inspection 1.2 Seed certification technique OR 2 Seed quality control parameters 2.1 Seed certification schemes 2.2 Cultivation practices of fiber crops.	
	COs:- On completion of this course the students will able to Understand the use and importance of seed certification 2. Develop the skill for seed quality control	
	** Activities Photographic collection and preparation of e-herbarium of local agricultural plants Crossing techniques of local agricultural plants in college garden, home kitchen garden. Project on local agricultural plants to be submitted at the end of session.	

Course Material/Learning Resources

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
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.Nema.

Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for Three Year UG/PG Programme

Programme: B.Sc

Semester IV

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/handson/Activity)	(No. of Periods/Week)
SDT(2S)/ SEED TECHNOLOGY		02

COs

By the end of the Lab/Practical Course, generally students would be able to:

- 1) Understand forms of gene interaction, hybridization, pollination techniques
- 2) Acquire the skill of preparation of slides of mitosis and meiosis.
- 3) Classify and identify different crop seeds.
- 5) Acquire knowledge of seed production practices planting, weed control, rogueing, harvesting and threshing

***List of Practical /Laboratory Experiments/Activities etc.**

S.N.	Experiments
Seed Testing :	
1.	Obtaining working sample, making separation, weighing, identification of purity components and reporting results.
2.	Testing of germination substrata and determination of moisture holding capacity of sand. 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.	Handling of moisture meter and determination of relative efficacy of moisture meter.
Seed Quality Control :	
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.	Observation in field inspection.
10.	Identification of objectionable weed plants and inseparable other crop plants.
11.	Study of varietal purity through examination of seeds, seedling and plants, recording of data and filling result forms
Additional activities	<p>1. Excursion (short/long) Visit to any Field area to study the Seed diversity and seed growing area in agriculture field.</p> <p>The excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination</p>
Submission	<p>1. Photographic herbarium of seed growing plants. 2. Tour reports or field visit report</p>

Sant Gadge Baba Amravati University, Amravati

Part A Faculty: SCIENCE and TECHNOLOGY

Programme: B.Sc. (Seed Technology)

Part B

Syllabus Prescribed for three Year UG Programme: Seed Technology

GENERAL INTEREST COURSE-3

Semester III

Code of the Course/Subject	Title of the Course/Subject	(No. of Periods/Week)
SDT(1S)/ SEED TECHNOLOGY	GIC-1 / Vegetable Seed Production.	30

COs

After completing this course, the students would be able to

1. Understand techniques of vegetable farming
2. Undertake classification of vegetable crops

Unit	Contents
Unit I: Vegetable Farming Introduction , Types: Home or Kitchen garden, Market garden, Truck garden, Garden for Vegetable Processing, Vegetable Farming for Seed Production Introduction to Vegetable Seed Production- Concept, History and objectives	15 Periods
Unit II: Classification of vegetable crops Classification based on growing season Classification based on plant part used for consumption Vegetable Nursery Management – Introduction, Types of Nursery beds <ol style="list-style-type: none">1. Raised bed2. Flat bed3. Hi-tech Nursery and Soil less raising of seedlings4. Precautions in raising healthy seedlings5. Transplantation	15 Periods

Course Material/Learning Resources

Text books:

1. Vegetables-B. R. Choudhary, 2014. Kalyani Publishers, New Delhi
2. Handbook of Agriculture- Indian Council of Agricultural Research, New Delhi
3. Plant breeding-B.D Singh, Kalyani Publishers, New , Delhi
4. Essentials of Plant Breeding- Phundan Singh, 2008
5. Experimental Seed Science and Technology -Umarani et. al. 2006., Agrobios, Jodhpur
6. Plant Breeding: Principles and Methods- Phundan Singh, 2009. Kalyani Publishers, New Delhi
7. Seed Technology- Agrawal, 2005. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
8. Principles of crop production-Reddy, 2008. Kalyani Publishers, New Delhi

Sant Gadge Baba Amravati University, Amravati

Part A

Faculty: SCIENCE and TECHNOLOGY

Programme B.Sc.

Part B

Syllabus Prescribed for three Year UG Programme: Seed Technology

GENERAL INTEREST COURSE-4

Seed Quality Control.

Semester- IV

Code of the Course/Subject	Title of the Course/Subject	(No. of Periods/Week)
SDT(2S)/ SEED TECHNOLOGY	GIC-II / Seed Quality Control	30

COs

After completion of this course, student would be able to

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.

Unit	Contents
Unit I: 1.1 Introduction 1.2 Definition of Seed Quality 1.3 Concept of seed quality control 1.4 Seed certification 1.5 Definition and Objectives, Concept, Classes of seed, Phases of Seed Certification, Procedure of seed certification	15 Periods
Unit II: 2.1 Seed certification agencies and its organization 2.2 Minimum seed certification standards- General seed certification standards, Specific crop standards. 2.3 Field inspection- Objectives and general principles, Method of inspection.	15 Periods

Course Material/Learning Resources

Suggested Readings

1. Handbook of Agriculture- Indian Council of Agricultural Research, New Delhi
2. Experimental Seed Science and Technology -Umarani et. al. 2006., Agrobios, Jodhpur
3. Seed Technology- Agrawal, 2005. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
4. Handbook of Biological Control and Horticultural Crops Vol-1 and 2, 2015- J. S. Bohra, Agrotech Press, New Delhi
5. Indian Insect Predators in Biological Control-K. Sahayaraj, 2004, Daya Publishing House, Delhi •
6. Quality Seed Production in Cotton- 2003, D. Kalavathi et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore
7. Quality Seed Production in Oil Seed Crops- 2003, P. Balamurugan et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore
8. Quality Seed Production in Pulses- 2003, K. Sivasubramaniam et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore
9. Quality Seed Production in Rice and Millets- 2003, V. Krishnasamy et. al., Department of Seed Science and Technology, Centre for plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore

Syllabus Prescribed for Three Year UG Programme Programme : B.Sc. II
Semester III **Seed Technology**

PRACTICAL- III
Hybrid Seed Production and Vegetable Seed Production
PRACTICAL EXAMINATION

Distribution of marks

Q. No.	Name of Question	Marks
1	Describe in details the floral biology of the specimen 'A' classify upto family level.	7
2	Raise a nursery bed for the given vegetable sample and describe.	7
3	Identify and describe vegetable seeds, specimen and equipments A, B, C, D, E.	7
4	Study of pollen germination in Sugar Solution.	8
5	Submission of visit reports .	7
6	Specimen collection and viva voce	7
7	Record book .	7
		Total Marks 50

Syllabus Prescribed for Three Year UG Programme Programme : B.Sc. II
Semester IV **Seed Technology**

PRACTICALS
Seed Testing and Seed Quality Control
PRACTICAL EXAMINATION

Distribution of marks

Q. No.	Name of Question	Marks
1	Filling of seed certification form in detail. 10 4. Determination of physical purity of seeds .	7
2	Moisture testing by oven dry method / seed germination test.	7
3	Identify and describe specimen A, B, C, D and E.	8
4	Preparation of seed samples by using seed triers	7
5	Submission of field visit report	7
6	viva-voce.	7
7	Record book	7
		Total Marks 50
