

Department of Seed Science & Technology

M.Sc. Programme

Course No.	Title of the course	Credits
1st Semester		
SST-501	Floral Biology, Seed Development and Maturation	1+1
SST-502	Principles of Seed Science	2+1
SST-503	Principles of Seed Production	2+0
2nd Semester		
SST-551	Seed Technology	2+1
SST-552	Seed Quality Testing	2+1
SST-553	Seed Physiology	1+1
SST-554	Quality Seed Production and Maintenance of Varieties	2+1
3rd Semester		
SST-601	Seed Legislation and Certification	2+1
SST-602	Seed Processing and Storage	2+1
SST-603	Seed Production of Field Crops	2+1
SST-604	Seed Production of Vegetable Crops	2+1
SST-649	Seminar –I	1+0
4th Semester		
SST-651	Seed Production of Flowers, Medicinal, Fruits and Plantation Crops	2+1
SST-699	Seminar-II	1+0
SST-700	Master's Research	0+20

SST- 501 Floral Biology, Seed Development and Maturation

1 + 1

Theory

UNIT I:Floral types, structure and biology in relation to pollination mechanisms; sporogenesis; microsporogenesis and megasporogenesis; gametogenesis – development of male and female gametes and their structures; effect of environmental factors on floral biology.

UNIT II: Fertilization – embryo sac structure, process, barriers to fertilization, incompatibility and male sterility, factors affecting fertilization.

UNIT III: Embryogenesis – development of typical monocot and dicot embryos; endosperm development, modification of food storage structures with reference to crop plants; different types of embryos, endosperm and cotyledons; Development and their structure in representative crop plants with reference to food storage; external and internal features of monocot and dicot seed; seed coat structure and development in representative crop plants.

UNIT IV: Apomixis – identification, classification, significance and its utilization in different crops for hybrid seed production; Polyembryony – types and significance; haplontic and diplontic sterility, causes of embryo abortion, embryo rescue and synthetic seeds.

Practical

Study of floral biology of monocots and dcots; microsporogenesis and megasporogenesis; study of pollen grains – pollen morphology, pollen germination and pollen sterility; types monocot and dicot embryos; external and internal structures of monocot and dicot seeds; seed coat structure, preparation of seed albums and identification.

SST- 502

Principles of Seed Science

2 + 1

Theory : Importance of Seed in agriculture. Different types of Seeds classified on the basis of botanical, production, chemical organization and storability. Concept on quality parameters of seed, Evaluation of basic quality parameters – purity, germination and vigor. International standards of seed quality, seed health and quarantine. Seed certification, Seed storage: principles and practices. External factors for deterioration of seed quality – pre and post harvest stage. Seed processing packaging and marketing.

Practical

Study seed types – starchy, oily, proteinecious, etc. study of viability pattern of orthodox and recalcitrant seeds. Study of seed quality parameters – purity, viability, health, vigour, germination from different seed samples. Grading of seed lots as per National standards.

SST-503

Principles of Seed Production

2 + 0

Theory

UNIT I: Introduction : Seed as basic input in agriculture; seed development in cultivated plants; seed quality concept and importance of genetic purity in seed production; types of cultivars, their maintenance and factors responsible for deterioration, seed production in self and cross pollinated crops.

UNIT II: Mode of pollination and reproduction in crop plants and their modification in relation to hybrid seed production. Principles of hybrid seed production, isolation distance, synchronization of flowering, rouging etc. male sterility and incompatibility system in hybrid seed production, role of pollinators and their management.

UNIT III: Seed multiplication ratios, seed replacement rate, demand and supply; suitable areas of seed production and storage, agronomy of seed production – agro climatic requirements and their influence on quality seed production; seed – criteria involved; life span of a variety and causes for its deterioration; certification standards for self and cross pollinated and vegetatively propagated crops.

UNIT IV: Hybrid Seed – Methods of development of hybrids; use of male sterility and self-incompatibility and CHA in hybrid seed production; one, two and three line system; maintenance of parental lines of hybrids; planning and management of hybrid seed production technology of major field crops and vegetables.

UNIT V: Planning of seed production for different classes of seeds for self and cross pollinated crops, seed quality control system and organization, seed village concept; seed production agencies, seed industry and custom seed production in India.

SST- 551

Seed Technology

2 + 1

History of Seed Improvement in India. Seed Biology : Anatomy, Morphology and development of seeds. Seed quality seed physiology; Seed dormancy and mechanism of germination. Seed purity causes of seed deterioration and its prevention. Principles and practices of Certified Seed production, genetic stock, Breeder seed, Foundation and the Certified seed. Seed production in cereals, pulses oilseed and forage legumes and certain vegetables of West Bengal Seed health; its importance, storage pest and pathogens. Recent trend in Seed Research.

Practical -

Seed Storage – Principles & practices, instruments used in seed technology.

SST 552

Sees Quality Testing

2 + 1

Theory

UNIT 1: Introduction : Structure of monocot and dicot seeds; seed quality : objectives, concept and components and their role in seed quality control instruments, devices and tools used in seed testing. ISTA and its role in seed testing.

UNIT II: Seed Sampling : definition, objectives, seed-lot and its size; types of samples; sampling devices; procedure of seed sampling; sampling intensity; methods of preparing composite and submitted samples; sub-sampling techniques, dispatch, receipt and registration of submitted sample in the laboratory, sampling in the seed testing laboratory.

UNIT III: Physical Purity definition, objective and procedure, weight of working samples for physical purity analysis components of purity analysis and their definitions and criteria; pure seed definitions applicable to specific genera and families; multiple seed units; general procedure of purity analysis; calculation and reporting of results, prescribed seed purity standards; determination of huskless seeds; determination of weed seed and other seed by number per kilogram; determination of other distinguishable varieties (ODV); determination of test weight and application of heterogeneity test.

UNIT IV: Seed moisture content : importance of moisture content; equilibrium moisture content; principles and methods of moisture estimation – types, instruments and devices used; pre-drying and grinding requirements, procedural steps in moisture estimation; calculation and reporting of results.

UNIT V: Germination : importance; definitions; requirements for germination, instrument and substrata required; principle and methods of seed germination testing; working sample and choice of method; general procedure for each type of method; duration of test; seedling evaluation, calculation and reporting results, dormancy : definition, importance, causal mechanisms, types and methods for breaking dormancy.

UNIT VI: Viability and Vigour Testing : definition and importance of viability tests; different viability tests; quick viability test (TZ-test) – advantages, principle, preparation of seeds and solutions, evaluation and calculation of test results Vigour testing concept, historical development, definitions, principles and procedures of different methods used for resting vigour.

UNIT VII: Genetic purity testing : objective and criteria for genetic purity testing; types of test; laboratory, growth chamber and field testing based on seed, seedling and mature plant morphology; principles and procedures of chemical, biochemical and molecular tests.

UNIT VIII:Seed health Testing : field and seed standards; designated diseases, objectionable weeds – significance of seed borne disease vis-à-vis seed quality – seed health testing and detection methods for seed borne fungi, bacteria, viruses and nematodes.

UNIT IX: Testing of GM seeds and trait purity, load of detection (LOD).

UNIT X:Preparation and dispatch of seed testing reports; storage of guard samples; application and use of seed standards and tolerances.

Practical

Structure of monocot and dicot seeds of important plant species; identification and handling of instruments used in seed testing laboratory; identification of seeds of weeds and crops; physical purity analysis of samples of different crops; estimation of seed moisture content (oven method) : seed dormancy breaking methods requirements for conducting germination test, specifications and proper use of different substrata for germination; seed germination testing in different agricultural crops; seedling evaluation; viability testing by tetrazolium test in different crops; seed and seedling vigour tests applicable in various crops; species and cultivar identification; genetic purity testing by chemical, biochemical and molecular methods; seed health testing for designated diseases, blotter methods, agar method and embryo count methods; testing coated/pelleted seeds.

SST- 553

Seed Physiology

1 + 1

Theory

UNIT 1:Physiology of seed development and maturation; chemical composition, synthesis and accumulation of seed reserves, induction of desiccation tolerance, hormonal regulation of seed development.

UNIT II: Seed germination; factors affecting germination; role of embryonic axis; growth hormones and enzyme activities, effect of age, size and position of seed on germination. Physiological processes during seed germination; seed respiration, breakdown of stored reserves in seeds, mobilization and interconversion pathways. Seed dormancy – types, significance, mechanism, endogenous and exogenous factors regulating dormancy, role of phytochrome and PGR, genetic control of dormancy.

UNIT III: Seed viability and longevity, pre and post-harvest factors affecting seed viability; seed ageing; physiology of seed deterioration; lipid peroxidation and other viability theories; means to prolong seed viability; mechanism of desiccation sensitivity and recalcitrance with respect to seed longevity.

UNIT IV: Seed vigour and its concept, vigour test methods, factors affecting seed vigour, physiological basis of seed vigour in relation to crop performance and yield. Seed invigoration and its physiological and molecular control.

Practical

Proximate analysis of chemical composition of seed; methods of testing viability; kinetics of seed imbibition and solute leakage; seed germination and dormancy breaking methods; seed invigoration and priming treatments; accelerated ageing and controlled deterioration tests; enzymatic activities and respiration during germination and effect of accelerated ageing, vigour testing methods etc.

SST-554 Quality Seed Production and Maintenance of Varieties 2+1

Theory

The concept of seed quality and its importance. Principles and methods of quality seed production in self and cross pollinated crops. Seed multiplication : principles and practices of quality seed production – breeder seed, foundation seed and certified seed. Genetics stock. Seed production in hybrid varieties. Purity of commercial seeds. Seed

certification and seed law as applied in seed production and maintenance. Causes of deterioration of strains. Methods of purity.

Practical

Study of different qualities of seeds in respect of size, shape colour, purity, viability germination, production of different qualities of seeds in field. Visit to farm and seed production centres.

SST-601 Seed Legislation and Certification

2+1

Theory

UNIT 1:Historical development of Seed Industry in India; Seed quality : concept and factors affecting seed quality during different stages of production, processing and handling; seed quality control-concept and objectives;

Central Seed Certification Board (CSCB).

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

UNIT III: Seed Certification – history, concept and objectives of seed certification; seed certification agency / organization and staff requirement; legal status and phases of seed certification; formulation, revision and publication of seed certification standards; Indian Minimum Seed Certification Standards (I.M.S.C.S) – general and specific crop standards including GM varieties field and seed standards; planning and management of seed certification programmes – eligibility of a variety for certification, area assessment, cropping history of the seed field, multiplication systems based on limited generation concept, isolation and land requirements etc.

UNIT IV: Field Inspection – principles, phases and procedures; reporting and evaluation of observations; pre and post-harvest control tests for genetic purity evaluation (grow-out tests); post harvest inspection and evaluation; seed sampling, testing, labeling, sealing and grant of certificate; types and specifications for tags and labels; maintenance and issuance of certification records and reports; certification fee and other service charges; training and liaison with seed growers. OECD seed certification schemes.

UNIT V: Introduction to WTO and IPRs; Plant Variety Protection and its significance; UPOV and its role; DUS testing – principles and applications; essential features of PPV & FR Act, 2001 and related Acts.

Practical

General procedure of seed certification; identification of weed and other crop seeds as per specific crops; field inspection at different stages of a crop and observations recorded on

contaminants and reporting of results; inspection and sampling at harvesting / threshing, processing and after processing for seed law enforcement; testing physical purity, germination and moisture; specifications for tags and labels to be used for certification purpose; grow-out tests for pre and post-harvest quality control; visits to regulatory seed testing laboratory, including plant quarantine lab and seed certification agency.

SST-602 Seed Processing and Storage

2 + 1

Theory

UNIT I: Introduction : Principles of seed processing; methods of seed drying including dehumidification and its impact on seed quality. Relative humidity and equilibrium moisture content of seed; Thumb rules of seed storage; loss of viability in important agricultural and horticultural crops, viability equations and application of nomograph.

UNIT II: Seed cleaning equipment and their functions : Preparing seed for processing; functions of scalper debearder, scarifier, huller, seed cleaner and grader. Screen cleaners, specific gravity separator, indented cylinder, velvet-spiral-disc separators, colour sorter, delinting machines; seed blending.

UNIT III: Assembly line of processing and storage, receiving, elevating and conveying equipments, plant design and layout, requirements and economic feasibility of seed processing plant.

UNIT IV: Seed treatments-methods of seed treatment, seed treating formulations and equipments, seed disinfestations, identification of treated seeds : Packaging : principles, practices and materials; bagging and labeling.

UNIT V: Seed storage : Seed drying and storage; drying methods-importance and factors affecting it, changes during storage, concepts and significance of moisture equilibrium, methods of maintaining safe seed moisture content. Methods to minimize the loss of seed vigour and viability; factors influencing storage losses. Storage methods and godown sanitation. Storage structures. Storage problems of recalcitrant seeds and their conservation.

Practical

Operation and handling of mechanical drying equipments; effect of drying temperature and duration on seed germination and storability with particular reference to oil seeds; seed extraction methods; seed processing equipments; seed treating equipments; visit to seed processing plant and commercial controlled and uncontrolled Seed Stores; seed quality upgradation; measurement of processing efficiency; seed blending, bag closures; study of orthodox, intermediary and recalcitrant seeds; evaluating seed viability at different RH and temperature levels and packaging materials; prediction of storability by accelerated ageing controlled deterioration tests.

Theory

UNIT 1: Basic principles in seed production and importance of quality seed. Floral structure, breeding and pollination mechanism in self-pollinated cereals and millets viz., wheat, barley, paddy, ragi etc.

UNIT II: Floral structure, breeding and pollination mechanism in cross-pollinated cereals and millets viz. maize, sorghum, bajra etc.; methods and techniques of quality seed production in cross-pollinated cereals and millets.

UNIT III: Floral structure, breeding and pollination mechanism; methods and techniques of seed production in pulses (pigeon pea, chick pea, green gram, black gram, field beans, peas, etc.).

UNIT IV: Floral structure, breeding and pollination mechanism; methods and techniques of seed production in major oil seeds (groundnut, castor, sunflower, safflower, rape and mustard, linseed, sesame etc.).

UNIT V: Floral structure, breeding and pollination mechanism; methods and techniques of seed production in commercial fibers (cotton, jute, mesta etc.) and vegetatively propagated crops like sugar cane, potato etc.

Practical

Planning of Seed Production, requirements for different classes of seeds in field crops – unit area and rate; Seed production in cross pollinated crops with special reference to land, isolation, planting ratio of male and female lines, synchronization of parental lines and methods to achieve synchrony; supplementary pollination, pollen storage, hand emasculation and pollination in Cotton, detasseling in Corn, identification of rogues and pollen shedders; Pollen collection, storage, viability and stigma receptivity; gametocide application and visits to seed production plots etc.

SST-604 Seed Production in Vegetables 2 + 1

Theory

UNIT 1: Introduction : modes of propagation in vegetables. Seed morphology and development in vegetable seeds. Floral biology of these plant species; classification of vegetable crops based on pollination and reproduction behaviour; steps in quality seed production; identification of suitable areas/locations for seed production of these crops.

UNIT II: Classification based on growth cycle and pollination behavior; methods of seed production; comparison between different methods e.g. seed-to-seed vs. root-to-seed method in radish; seed multiplication ratios in vegetables; pollination mechanisms; sex types, ratios and expression and modification of flowering pattern in cucurbits; nursery raising and transplanting stage.

UNIT III:Seed production technology of vegetables viz. solanaceous, cucurbitaceous, leguminous, malvaceous, cole crops, leafy vegetables, root, tuber and bulb crops and spices; harvesting / picking stage and seed extraction in fruit vegetables; clonal propagation and multiplication in tuber crops e.g. Potato, sweet potato, colocasia, tapioca; seed-plot technique in potato tuber seed production; hybrid seed production technology of vegetable crops, TPS (true potato seed) and its production technique; hybrids in vegetables; maintenance of parental lines; use of male sterility and self incompatibility in hybrid seed production, environmental factors related to flowering / bolting in vegetable crops.

UNIT IV:Share of vegetable seeds in seed industry; importance and present status of vegetable industry; intellectual property rights and its implications, impact of PVP on growth of seed industry.

Practical

Selection of suitable areas / locations for high quality seed/planting material production; study of floral biology of vegetables, determination of planning ratios for hybrid seed production vegetables; use and maintenance of monoecious line in hybrid seed production of

cucumber; exercises on emasculation and pollination; seed extraction methods and their effect on quality of vegetables; seed production technology of varieties and hybrids in vegetables.

SST-651 Seed Production in Flowers, Medicinal, Fruyits and Plantation Crops 2 +1

Theory

UNIT I: Introduction : modes of propagation in fruits, flower and plantation crops. Floral biology of these plant species; classification of medicinal and horticultural crops based on pollination and reproduction behavior; steps in quality seed production; identification of suitable areas/locations for seed production of these crops.

UNIT II: Flowers and Medicinal Plants; classification based on growth cycle, reproduction and pollination behavior; nursery requirement, planning and management; technology for quality seed production in important flower species i.e. margigolds, petunias, dahlia, roses, gladiolus, tulips, chrysanthemum etc; development of hybrids and their seed production technology flower plants. Seed production technology of annual medicinal plants viz. isabgol, ashawagandha etc.

UNIT III: Fruit and Plantation Crops : role of seed in perennial plant species; classification based on reproduction and pollination behavior, polyembryony and its significance: nursery requirement, planning and management; clonal propagation and multiplication in tropical, sub-tropical and temperate fruits and plantation crops; seed orchards; seed collection, extraction and processing.

UNIT IV: IPR issues with special reference to floral and plantation crops.

Practical

Selection of suitable areas/locations for high quality seed/planting material production; study of floral biology of flowers, fruits, medicinal and plantation crops; determination of planting ratios for hybrid seed production in flowers; exercises on emasculation and pollination;

seed extraction methods and their effect on quality of fruit; seed production technology of varieties and hybrids; seed; seed collection and extraction in fruit and plantation crops.