02 SEED SCIENCE & TECHNOLOGY

Unit 1 : Seed Biology

Floral biology, mode of reproduction, sporogenesis, pollination, fertilization, embryogenesis, fruit and seed development and physiological and harvestable maturity. Apomixis, parthenocarpy, polyembryony and somatic embryoids and synthetic seeds. Seed structure of monocot and dicot. Seed maturation and maturation drying in orthodox and recalcitrant seed. Seed chemical composition. Seed dormancy - types, causes, methods to overcome dormancy. Seed germination - phases, types and requirements. Physiological and biochemical changes in germinating seed. Role of hormones in dormancy and germination.

Unit 2 : Seed Production

Genetic purity - concept and factors responsible for deterioration of varieties. Maintenance breeding. Generation system of seed multiplication. Seed production agencies - public and private. Compact area approach / seed village concept in seed production. Seed Replacement Rate, Seed Multiplication Ratio, Seed Renewal Period, Varietal Replacement Rate. Seed production planning. Factors affecting pollination and seed set *viz.*, temperature, humidity, wind velocity, insect pollinators and supplementary pollination. Male sterility, self-incompatibility and their role in hybrid seed production. Techniques of hybrid seed production - emasculation and pollination, detasseling, male sterility, sex expression, self-incompatibility and chemical hybridizing agents. Principles and methods of seed production of varieties and hybrids of cereals - wheat, paddy, sorghum, pearl millet and maize; pulses - chickpea, pigeon pea, green gram, black gram, soybean and cowpea; oilseeds - groundnut, brassica, sesame, sunflower and castor; fibre crops - cotton and jute; vegetable crops - tomato, brinjal, okra, chilli, cabbage, cauliflower, radish, knol khol, turnip, carrot and cucurbitaceous crops; important forage legumes - lucerne, desmanthus and grasses - cumbu napier and fodder sorghum ; plantation crops - coffee, tea, rubber, cocoa, cardamom, coconut and pepper. Disease free clonal propagation of crops - potato, sugarcane, tapioca, fruit crops - mango, citrus. apple, pear, plum. Clonal propagation of annual and perennial flowers like rose, gladiolus, chrysanthemum, marigold, dahlia, phlox and petunia. Clonal standards and degenerations. Micro propagation.

Unit 3 : Seed Processing

Principles of seed processing. Processing sequence for different crops. Layout of seed processing unit. Seed drying - principles and methods. Pre-cleaning, grading, upgrading, seed treatment and packaging. Working principles of seed processing machines *viz.*, cleaner cum grader, specific gravity separator, indented cylinder separator and seed treater. Seed quality maintenance during processing. Seed enhancement techniques - seed coating, pelleting and priming.

Unit 4: Seed Quality Control

Seed legislation - the Seeds Act 1966, Seed Rules 1968, Seed Control Order, 1983 and Seed Bill 2004. Seed certification - history, concept, organization, phases and Indian minimum seed

certification standards. Field inspection principles and methods. Inspection at harvesting, threshing and processing. Pre-and post-processing quality testing of seed. Seed testing concepts and objectives, its role in seed quality control. Seed sampling, seed moisture testing, purity analysis, germination testing, tolerance limit and seed testing equipments. Quick viability test and seed standards. Seed vigour, its significance and testing methods. Testing for genuineness of varieties – principles and methods based on seed, seedling and plant characters, biochemical techniques - electrophoresis of proteins and isoenzymes and DNA fingerprinting. International Seed Testing Association (ISTA), its role in development of seed testing procedures, rules and seed quality assurance for international seed trade. OECD seed certification guideline - agricultural and vegetable crops.

Unit 5 : Seed Storage

Seed storage - principle - purpose and types - short, medium and long term storage. Factors affecting seed storage and role of moisture, temperature and relative humidity. Viability nomographs. Longevity of orthodox and recalcitrant seeds. Seed deterioration causes and methods of control. Physiological, biochemical and molecular changes in seed ageing. Controlled storage. Germplasm storage. Cryo preservation. Seed storage containers, types - safe moisture content. Storage structures. Methods of stacking and their impact on seed quality. Seed storage godown maintenance and sanitation. Management of carry over seed.

Unit 6 : Seed Health

Significance of seed health. Procedures for seed health test and rules. Externally and internally seed - borne pathogens, mode of infection, development and spread, methods of detection. Important seed-borne diseases of cereals, oilseeds, pulses, fibre crops, vegetables and their control measures. Quarantine and International procedures of phytosanitary certificates. Important storage pests, their identification, monitoring and detection. Use of pesticides, botanicals, mycotoxins for seed treatments. Carry over infestation, principles of fumigation and safe use of fumigants.

Unit 7 : Seed Industry Development and Marketing

National and International seed industry development. Role of OECD and WTO in International seed trade. International Seed Federation (ISF). Market survey, demand forecasting, pricing policies, marketing channels, planning and sales promotion. Economics of seed production. Role of Government, semi Government, cooperative and private sectors in seed trade. Responsibilities of seed companies and dealers in Seed Act. Seed import and export.

Unit 8 : Protection of Plant Varieties

Plant Variety Protection (PVP) and its significance. International Union for the Protection of New Varieties of Plants (UPOV) and its role in development of Plant Breeders Rights and Seed Industry Development. UPOV 1978 and 1991 Acts. Plant Breeders Rights and exceptions to it. Breeders exemption and farmers privilege. Plant patent v/s Plant breeders rights. Impact of PVP

on seed supply system. Protection of Plant Varieties and Farmers' Right Act, 2001, its essential features. Criteria for protection of different types of plant varieties. DUS testing principles and application. Breeders, Researchers and farmers rights. Compulsory licensing. Indian Biological Diversity Act, its essential features. Access to Biological resources, benefit sharing.