Course :	GPB 232	Credit:	2(1+1)	Semester-III
Course title:	Fundamentals of Plant Breeding			

Syllabus

Theory

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization and Introduction; Centres of origin/diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self-pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes- Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregation populations. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiments, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out-crossing. Prediction of performance of double cross hybrids.

Teaching Schedule

a) Theory

Lecture	Topic	Weightages (%)
1.	Definition, history of plant breeding, aims and general objective of plant breeding Land marks of plant breeding, Indian plant breeders,	8

Lecture	Topic	Weightages (%)
	General objectives of plant breeding Major achievements, Future Prospects	
2.	**Self incompatibility-** Definition, classification, heteromorphic SI, its features, distyly, tristyly, homomorphic SI, its types i.e. gametophytic SI and sporophytic SI, its features, utilization of self incompatibility in plant breeding	6
3	**Male sterility-** Definition, Classification/types, Genetic MS, Thermosensitive Genetic MS, Photosensitive Genetic MS, Transgenic MS, Cytoplasmic MS, Cytoplasmic Genetic MS, Chemical Hybridizing Agents	6
4	**Heritability-** Definition, types-narrow and broad sense heritability **Components of genetic variation-** Classification, definition and features of additive, dominance and epistatic variance, gene action	5
5	**Concepts of population genetics-** Definition and concept of population genetics, random mating population, gene and genotypic frequency **Hardy-Weinberg law-** Law, its validity, factors affecting gene frequency	5
6	**Breeding Methods in self pollinated crops** **List of breeding methods** **Plant Introduction-** Definition, purpose, types i.e. primary and secondary introduction, advantages and disadvantages **Acclimatization-** Definition, concept, factors affecting acclimatization	5
7	**Pure line selection-** uses of pure line, merits, demerits, achievements **Mass selection-** Definition, genetic basis, main features, positive and negative selection, detailed procedure of development of variety by mass selection, its merits, demerits, achievements	5
8	**Handling of segregating population through Pedigree method-** detailed procedure of pedigree method, its merits, demerits, achievements	5
9	**Handling of segregating population through Bulk method-** Concept of bulk method, short term, long term, its application, procedure of bulk method, its merits, demerits, achievements **Handling of segregating population through Single seed descent method-** concept of SSD method, its application, detailed procedure of SSD method, its merits, demerits, achievements	4

Lecture	Topic	Weightages (%)
10	**Back cross method-** Definition of backcross, its objective, requirements and applications of backcross method, procedure for transfer of dominant gene **Back cross method-** procedure for transfer of recessive gene, merits, demerits, achievements of backcross method	5
11	**Methods of breeding in cross pollinated crops**- list of plant breeding methods for cross pollinated crops **Modes of selection-** Recurrent selection, its types and its procedure	5
12	**Hybridization techniques-** Definition, aim and objectives, types of hybridization, steps and procedure of hybridization programme **Wide hybridization-** Definition, types, main features, interspecific and intergeneric hybridization, its examples, incompatibility barriers for wide hybridization, techniques for overcoming incompatibility barriers, achievements	10
13	**Composite and synthetic varieties-** Definition, steps for development of composites and synthetics, procedure of developing composites and synthetics, its merits, demerits and achievements	5
14	**Breeding methods in asexually propagated crops:** List of breeding methods for asexually propagated crops. **Clonal selection-** Definition, features of asexually propagated crops, procedure of clonal selection, its merits and demerits **Hybridization-** steps and procedure of hybridization in clonal crops	6
15	**Mutation breeding method and its uses –** Definition of mutation breeding, conditions in which mutation is rewarding, procedure of mutation breeding for seed and vegetatively propagated crops, applications, its merits, demerits and achievements **Polyploidy in relation to plant breeding-** Definition of haploid, monoploid, diploid, polyploid, genome, heteroploidy, annuploidy, euploidy, types of annuploidy its application in crop improvement, types of polyploidy (natural occurring and artificial) and its role in crop improvement, effects of polyploidy, its application in crop improvement and limitation	12
16	**Heterosis-** Definition, heterosis and hybrid vigour, effects and estimation of heterosis, genetic basis/theories of heterosis **Inbreeding depression-** Definition, effects of inbreeding	8
Total		**100**

b) Practical

Experiment	Exercise
1	Plant Breeder's kit
2	Study of germplasm of various crops
3	Study of floral structure of self pollinated crops
4	Study of floral structure of cross pollinated crops
5	Emasculation and hybridization techniques in self pollinated crops : Green gram, Black gram, Rice, Wheat, Groundnut, Soybean,
6	Emasculation and hybridization techniques in self pollinated crops : Sesame, Chickpea, Okra, Tomato, Brinjal, Chilli,
7	Emasculation and hybridization techniques in cross pollinated crops : Maize, Bajra, Sunflower, Papaya, Sugarcane,
8	Emasculation and hybridization techniques in often cross pollinated crops : Cotton, Sorghum, Pigeonpea, Safflower
9	Consequences of inbreeding on genetic structure of resulting populations
10	Study of male sterility system
11	Handing of segregation populations
12	Methods of calculating mean, range, variance, standard deviation, heritability
13	Designs used in plant breeding experiment
14	Analysis of Rondomized Block Design
15	To work out the mode of pollination in a given crop and extent of natural out crossing
16	Prediction of performance of double cross hybrids

Suggested Readings:

Sr. No	Title of Book	Author/Authors	Publisher
1.	Plant Breeding Principles and Methods	B. D. Singh	KalyaniPublication New Delhi.
2.	Essentials of Plant Breeding	Phundansingh	Kalyani Publication New Delhi
3.	Principles and Practices Plant Breeding	J. R. Sharma	McGraw Hill Publishing company Limited , New Delhi.

4.	Plant Breeding Theory and Practices	V. L. Chopra	Oxford and IBH. Publishing Company , New Delhi.
5.	Introduction to Plant Breeding	R. C. Choudhary	Oxford and IBH. Publishing Company , New Delhi.
6.	Elementary Principles of Plant Breeding	R. C. Choudhary	Oxford and IBH. Publishing Company , New Delhi.