Name of Programme: M.Sc. (Ag.) Genetics and Plant Breeding

Academic eligibility for admission: - B.Sc. (Ag.)

Curriculum and Syllabus

Semester	Course Code & No.	Course Title	Credit Hrs.	Mid Exam.	Final Exam		Total
					Theory	Practical	
Ist Sem.	GPB-6361	PRINCIPLES OF GENETICS	3 (2+1)	20	40	40	100
	GPB-6362	PRINCIPLES OF CYTOGENETICS	3 (2+1)	20	40	40	100
	GPB-6363	PRINCIPLE OF SEED PRODUCTION	3 (2+1)	20	40	40	100
	AST-6364	Statistical Methods	3 (2+1)	20	40	40	100
		Total	12				
IInd Sem	GPB-6365	PRINCIPLE OF PLANT BREEDING	3 (2+1)	20	40	40	100
	GPB-6366	QUANTITATIVE GENETICS	3(2+1)	20	40	40	100
	GPB-6367	MOLECULAR GENETICS	3 (2+1)	20	40	40	100
	AST-6368	Design of Experiments	3(2+1)	20	40	40	100
		Total	12				
IIIrd Sem	GPB-7361	ADVANCED PLANT BREEDING	3(2+1)	20	40	40	100
	GPB-7362	MATING DESIGN OF PLANT BREEDING	3(2+1)	20	40	40	100
	GPB-7363	GENETIC CONTROL OF PLANT REPRODUCTION	3(2+1)	20	40	40	100
	GPB-7364	BREEDING FOR DISEASE RESISTANCE	3(2+1)	20	40	40	100
		Total	12				
IVth Sem	GPB-7365	BREEDING FOR CROP QUALITY	3(2+1)	20	40	40	100
	GPB-7366	GENETIC ENGINEERING AND BIOTECHNOLOGY	3(2+1)	20	40	40	100
	GPB-599	Seminar	1	Satisfactory/Unsatisfactory			
	Optional (any one from two)						
	GPB-7367	FUNDAMENTAL OF CYTOLOGY	12(9+3)	20	40	40	100
	or						
	GPB-598	Thesis Research	12	40 % Internal +60% External)			100
		Total	19				
		Grand Total	55				

GPB 6361: PRINCIPLES OF GENETICS

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

i. History and Developn1ent of Genetics

ii. Mendel and Mendel's Principles

iii. Gene action and Interaction (Factor Hypothesis)

iv. Multiple alleles

v. Blood group and Its genetic basis

vi. Multiple gene (Quantitative inheritance)

vii. Linkage and crossing over

viii. Sex linked character, sex influenced characters and sex limited characters.

ix. Sex determination

x. Mutation

xi. Cytoplasmic inheritance.

xii. Population genetics

xiii. Introduction to Eugenics

Practical: Related to the Course

GPB 6362: PRINCIPLES OF CYTOGENETICS

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

i. History of cytogenetics

ii. Chromosome and its fine structure

iii. Special chromosome viz; lambrush chromosome, polytene chromosomes, B Chromosomes, sex chromosome, artificial chromosome.

iv. Cell division (Mitosis and meiosis cell division), Cell (ultra. fine structure), Cell cycle

v. Chromosomal aberration

vi. Numerical changes in chromosome.

Practical: Related to the Course

GPB 6363: PRINCIPLE OF SEED PRODUCTION

(Credit Hours : 2+1 = 3) (MARKS: MID 20 + THE 40 + PRA. 40 = 100)

Seed industry development. Classification of crop plant in relation to mode of reproduction, variety : definition type, development, release system and notification. Objective of seed productions, Generation system. Factors affecting to seed productions; site selection, isolation and rouging; compact area approach. Variety maintenance, nucleus, and breeder seed production in different crops. Hybrid seed production. Two and three line system of hybrid seed production. Development of A, B and R lines. Male sterility, its kind and use in hybrid seed production. Self-incompatibility, its genetics and use in hybrid seed production, causes for seed deterioration. Seed production, methods, processing and storing in rice, wheat, maize, sorghum, pearl millet, barley, red gram, gram, cowpea, pea soybean, groundnut, castor, mustard, sunflower, linseed, cotton and tobacco, seed Act. 1966. -

Practical: Related to the Course

IInd Semester

GPB 6365: PRINCIPLE OF PLANT BREEDING

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

Introduction to plant breeding - history, objectives, achievement in the prc-mendelian era, post - mendelian plant breeding, potential and opportunities. Introduction, demonstication and acclimatization, a con. patterns of evolution in crop plants. Centres of origin, gene pool concept - primary, secondary and tertiary gene pool and gene introgression. Plant genetic resources: importance of plant genetic resource and diversity in plant breeding, collection, evaluation and conservation of germplasrn. Modes of reproduction in plants - asexual & sexual reproduction, self and cross - pollination mechanisms, male - sterility and self incompatibility .

Genetic basis of plant breeding: genetic consequences of self and cross fertilization, genetics of self incompatibility. mating systems>- genetics & phenotypic assorative and disassortative mating and their genetic consequences; Qualitative & quantitative and disassortative matings and their genetics consequences; qualitative quantitative traits and

their genetic behavior in segregating populations; components of variation, single gene and multiple gene concepts, epistasis and gene interactions; Heritability and genetic advances; selection - response to selection, selection differential, intensity and realized advance; Heterosis - concept and theories, inbreeding de presson.

Methods of breeding self-pollinated, cross-pollinated and asexually propagated crops; Land races, pure line selection and mass selection; pedigree selection, bulk method and its modification;. Hybrid breeding, population and population improvement, intra and inter population improvement: clonal selection. Mutation breeding, use of polypoidy and distant hybridization in plant breeding.

Mechanisms and genetic bases of resistance/ tolerance to biotic and abiotic stresses' in plants, breeding for resistance/ tolerance.

Application of biotechnology to plant breeding - embryo rescue, somaclonal variation, doubled haploid, protoplast fusion, transgenic. Molecular plant breeding. bio-safety issues involved with genetically modified organisms.

Released and registration of new varieties, quality seed - classes, production practices and maintenance of pure seed, purity standards, UPOV convention and convention on biodiversity.

Practical: Related to the Course

GPB 6366: QUANTITATIVE GENETICS

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

i. Introductory statistics, experimental designs.

ii. Introduction to quantitative genetics.

iii. Assesmental of polygenic variation.

iv. Co-rrelation, path and discriminate function

v. Diallel, paritial diallel and line X tester technique

vi. Generation means, bi-parental malting and triple test cross technique

vii. Analysis of adaptation and stability.

viii. Component of genetics variances.

ix. Heritability and genetic advance

x. Heterosis and inbreeding depression.

Practical: Related to the Course

GPB 6367: MOLECULAR GENETICS

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

i. Identification of genetic material

ii. Structure of gene

iii. Structure of DNA and RNA

iv. Genetic code

v. Genetic control of protein synthesis

vi. One gene one plypeptide chain vu. Transcription and translation

vii. Regulatory gene and operan concept.

viii. Life cycle of nurospora, E. coli and bacteriophase

ix. Recombination in bacteria.

x. Transduction, conjugation and their genetic expression and its control.

Practical: Related to the Course

IIIrd Semester

GPB :7361 ADVANCED PLANT BREEDING

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

Components of variation and their estimation in single gene and polygenes, segregating populations, breeding values, additive non-additive genetic components, epistatic components, variance components among early and advanced generation segregating populations, effect of population size- their significance in decision making in plant breeding. Selection theory, types of selection, response to selection, selection advance, criteria of selection, selection limits, direct and indirect selection, multi-trait selection and construction of selection index, correlated response.

Heteorosis and genetic bases of heterosis; prediction of heterosis, estimation and evaluation - F2 heterosis - genetic degeneracy consequences. Breeding methods of self-

pollinated crops: pedigree and bulk selection and their genetic consequence, Grid selection (adoption of honey 0 comb, fan or other such designs) in breeding populations. Multiline - clean and dirty crop approach, genetic consequences, advantages and disadvantages; Recurrent selection and hybrid breeding. Breeding methods for cross pollinated crops: mass selection, recurrent selection and population improvement: intra-population improvement, selection bases on individual family and combining ability; interpopulation improvement: breeding composite and synthetic populations. Hybrid breeding: Hybridsin self and cross pollinated crops - their bases, heterotic pool concept; Development and improvement of heterotic pools and inbred lines, evaluation of inbred lines and hybrids; production of hybrid seed - use of male sterility & its restoration mechanisms and genetic manipulation in hybrid breeding, apomixes in fixing heterosis. Genetic characteristics of pure lines, inbreeds, hybrids, clones, mixtures & multi-lines, composites and synthetics, their maintenance and multiplication.

Practical: Related to the Course

GPB 7362: MATING DESIGN OF PLANT BREEDING

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

Mating designs: Plant breeding applications, genetic component analyses through diallel. North Carolina designs, line X tester mating design and three-factor mating designs - covariance, genetic parameters, heritability, combining abilities, genetic parameters, heritability, progeny evaluation and parental selection, decision making options in development of breeding strategies for improvement of the target traits.

Genotype X environment interaction: Analysis of variance over multiple environments, stability models - regression approaches, estimation of stability indices; best linear unbiased prediction (BLUP).

Molecular - marker assisted selection (MAS) : types of molecular markers.' their inheritance and maping molecular markers, MAs for qualitative traits like abiotic and biotic stress resistance, Quantitative Trait Loci (QTLs) ., Maping QTLs, MAS for QTL improvement Regression approach, single marker and multiple marker approach, i interval - markers.

Practical: Related to the Course

GPB 7373: GENETIC CONTROL OF PLANT REPRODUCTION

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

Pollination mechanism and fertilization process and its analysis : Genetics and molecular biology of male and female gametes. Anther and ovule development. Pre-and post-fertilization barriers in wide crosses _ principles and techniques to overcome fertility barriers; In vivo and in .vitro fertilization mechanisms and its application for crop improvement; Male sterility - types and mechanisms - methods of inducing male sterility crop plants. Anther specific genes and their utility in developing male sterility. Pollination mechanisms and their evaluation. Gene-flow studies in relation to transgenic. Self-incompatibility-cellular, genetic and molecular basis, male gametophytic selection and its application. S gene structure and function (case studies: tomato, Brassica, tobacco). Somatic hybridization in crop plants, apomizes - mechanism forms and application. Limitations, progress and prospects of transfer of apomictictrait _ to crop plants. Haploid parthenogenesis induction, detection and Uses.

Practical: Related to the Course

GPB 7374: BREEDING FOR DISEASE RESISTANCE

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

History-disease development, mechanism of resistance phenomena (types of resistance, level of resistance, characteristic, resistance reaction, different classes of resistance, related to phenomena like horizontal and varietals resistance), physiological specialization, gene for gene hypothesis, boom and burst cycle, genetic variability, gene pyramiding, gene deployment, multiline concept, vertifolia effect, endemicity, patho-system, mechanism of variability with pathogen, genetic basis of resistance, molecular interaction of host pathogen, breeding strategies for disease resistance, breeding method for disease resistance (bulk, pedigree, backcross), management of resistance failure, causes for resistance failure, testing of resistance variety.

Practical: Related to the Course

IVth Semester

GPB 7365: BREEDING FOR CROP QUALITY

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

Quality traits in field crops need and prospects for genetic improvement; genetics of quality traits and their variability, correlation, heritability and association with yield; breeding objectives, approaches and achievements in improvement of quality. traits in

specific crops ; wheat - chemical composition of the grain, genetics and significance of storage proteins; evaluation of nutrition, cooking, ecological, baking & chapati making properties; rice - chemical, composition, genetics and evaluation of nutritional and cooking quality characters viz. Amylose, gelatinization temperature, gel consistency, kernel elongation ratio & aroma: Maize properties of corn, starch specially corn, high quality protein, biochemical and genetically studies of kernal mutants (opaque - 2, floury 2 etc.) ; Fodder quality evaluation; pulses - breeding for quality protein and genetic removal of anti-nutritional factors ; oil seeds - breeding for brassicas, low erucic acid & glucosinolates, high linoleic acid & oil content; cotton -fiber quality components, seed processing and utilization.

Practical: Related to the Course

GPB 7366: GENETIC ENGINEERING AND BIOTECHNOLOGY

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

Introduction to plant genetic engineering and biotechnology, gene identification, gene isolation, synthesis of genes and gene cloning. Restriction enzyn1es and vectors, regeneration in crop plants. Gene transfer systems-vector mediated gene transfer, microinjection, electroporation, direct DNA uptake, gene gun technique. Selectable markers and reporter system. Application of plant genetic Engineering and biotechnology - Transgenic crops application of recombinant DNA technology - current status and future prospects. Regulation mechanism for genetically modified crops.

Practical: Related to the Course

GPB 7367: FUNDAMENTAL OF CYTOLOGY

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

i. The cell theory

ii. Structure and function of cell organelles Viz. Mitochondria plastids, Lysosomes, Eridoplasmic Reticulum, microsomes. Golgi Bodies cell membrane chromosome, and spindle fibres

iii. Chromosome morphology

iv. Cell division - somatic and gametic

v. DNA and RNA studies

vi. Microscope - simple compound, Ultra violet phase contrast, electron, x-ray

diffraction.

Practical: Related to the Course

AST 6364: STATISTICAL METHODS

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

Frequency distribution, classification and tabulation of data, graphical and diagrammatic representation of data, measures of central tendency, measures of dispersion, coefficient of variance, standard error, skewness & kurtasis .

Cansus & sample survey, population and sample, probability concept of random sampling, simple random sample, stratified sampling systematic & cluster sampling parameter & sample value. Testing of hypothesis. test of signification based on Z t and F test x^2 - test far goodness of fit and independence of attributes.

Scattered diagram. Linear regression & correlation, regression and correlation coefficient.

Practical: Related to the Course

AST 6368: DESIGN OF EXPERIMENTS

(Credit Hours: 2+1 = 3) **(MARKS: MID 20 + THE 40 + PRA. 40 = 100)**

Analysis of variance. Basic principal of experimental design, CRD" RBD, LSD with their analysis mission plot techniques in R.B.D. and L.S.D. Factorial experiments its concepts and analysis of 2^3, factorial. Confounding in symmetrical factorial (in 2^3 experiments), split plot design, strip plot design, uniformity trials. Progeny row trials. Complect family black design, with over trials & simple rotational experiments. Statistical organization, statistics of livestock & fistrics source of livestock and agriculture in general. Source of official statistician. Crop cutting experiments.