

**Proposed  
National Education Policy 2020 Inserted Pre-Ph. D.  
Course Work for**

**Doctor of Philosophy  
in  
Genetics and Plant Breeding**

**(Academic Session: 2022-23 onwards)**



**Examine and approved by:**  
*Board of Studies- Genetics and Plant Breeding*  
**Maharaja Suhel Dev State University,**  
**Azamgarh-276 128, Uttar Pradesh (INDIA)**



**Pre-Ph. D. Course work for Ph. D. in Genetics and Plant Breeding**

The Pre-Ph. D. course work for **Doctor of Philosophy in Genetics and Plant Breeding** shall comprise of only one semester (i.e., I-semester) in which there shall be three compulsory papers and one major research project.

***Distribution of Courses in the I Semester***

I-Semester				
Course Code	Type of course	Paper	Title of the course	Credit hr
GPB-601	Compulsory (Major Subject)	I	Molecular genetics and Genomics in crop Improvement.	6(4+2)
GPB-602	Compulsory (Major Subject)	II	Advances in Plant Breeding Systems.	6(4+2)
GPB-603	Compulsory (Research Methodology)	III	Research methodology, Statistics and Computer Application.	4(3+1)
GPB-604	Compulsory (Major Research Project)	--	Major Research Project	Non-credit /qualifying

**Note:** The research work and Ph. D. thesis shall be completed as per then effective UGC (Minimum Standards and Procedure for Award of Ph. D.) Regulation and accordance with the Ordinance made for same by the university.





Name of the Subject: Genetics and Plant Breeding					
Course/ paper code:	GPB-601	Course/ paper title:	Molecular genetics and Genomics in crop Improvement.	Credit assigned	6(4+)
Type of course	Compulsory	Semester	I		
Unit	Topic (Theory)				M. L
I	Dynamic concept of gene, its structure, function and regulation of expression in prokaryotes and eukayotes. Pre-Mendelian concept of gene: Physical basis of heredity; Gene concept in classical genetics: Mendelian concepts of inheritance, gene interactions, recombination and linkage in lower and higher organism, crisscross inheritance, gene mapping; Intra- and Inter-genic complementation: complementation as test of allelism, complex loci, pseudoallels.				10
II	Introduction to the plant genome- Plant nuclear genomes and their molecular description - The chloroplast and the mitochondrial genomes in plants - Genome size and complexity.				10
III	Establishment of plant genome mapping projects – Genome mapping anduse of molecular markers in plant breeding; Strategies for mapping genes of agronomic traits in plants- Approaches for mapping quantitative trait loci;Map based cloning of plant genes.				10
IV	Regulation of Plant gene expression – Functional genomics – Expression Analysis using Microarrays – Transposon tagging and Insertionalmutagenesis- methods and significance- Diversity Array Technology.				10
V	Genome sequencing in plants-Principles and Techniques; Applications of sequence information in plant genome analyses; Comparative genomics-Genome Comparison Techniques- Classical and advanced approaches.				10
VI	Concept of database development, management and bioinformatics; Plant genome projects and application of bioinformatics tools in structural and functional genomics.				10
	Practical				
	Isolation, purification and raising clonal population of a bacterium; Biological assay of bacteriophage and determination of phage population in lysate; Study of lytic cycle of bacteriophage by one step growth experiment; determination of latent period and burst size of phages per cell; Quantitative estimation of DNA, RNA and protein in an organism; Numericals: problems and assignments.				30
Suggested readings including digital platforms	<ul style="list-style-type: none"><li>• Baxevanis AD &amp; Ouellette BFF. 2001. Bioinformatics: A Practical Guide to the Analysis of Genes ar Proteins. Wiley Interscience.</li><li>• Brown TA. 2002. Genomes. Wiley-LISS.Caetano-Anolles G &amp; Gresshoff PM. 1998. DNA Markers: Protocols,</li><li>• Applications and Overviews. Wiley-VCH.Cantor CR &amp; Smith CL (2004). Genomics. Wiley, New York</li><li>• Galas DJ &amp; McCormack SJ. 2002. Genomic Technologies: Present andFuture. Calster Academic Pre</li><li>• Jordan BR. 2001. DNA Microarrays: Gene Expression Applications.Springer-Verlag.</li><li>• Liu BH. 1997. Statistical Genomics: Linkage, Mapping and QTL Analysis.CRS Press.</li><li>• Lynch M &amp; Walsh B. 1998. Genetics and Analysis of Quantitative Traits.Sinauer Associates.</li><li>• Mount DW. 2001. Bioinformatics. Sequence and Genome Analysis. ColdSpring Harbor Laboratory Press..</li><li>• Palzkill T. 2002. Proteomics. Kluwer.Paterson AH. 1996. Genome Mapping in Plants. Academic Pre</li><li>• Pennington SR &amp; Dunn MJ. 2002. Proteomics: From Protein Sequence toFunction. Viva Books.</li><li>• Rampal JB. 2001. DNA Arrays: Methods and Protocols. Humana Press.</li></ul>				



Name of the Subject: Genetics and Plant Breeding					
Course/ paper code:	GPB-602	Course/ paper title:	Advances in Plant Breeding Systems .	Credit assigned	6(4+2)
Type of course	Compulsory	Semester	I		
Unit	Topic (Theory)				M. L.
I	Facts about plant breeding before the discovery of mendelism; evolutionary concepts of genetics and plant breeding – Flower development and its importance; genes governing the whorls formation and various models proposed; Mating systems and their exploitation in crop breeding; Types of pollination,mechanism promoting cross-pollination.				10
II	Self-incompatability and sterility – Types of self incompatability:homomorphic (sporophytic and gametophytic) and heteromorphic-Breakdown of incompatibility –Floral adaptive mechanisms- spatial and temporal-Genetic and biochemical basis of self- incompatibility; sterility:male and female sterility-Types of male sterility: genic, cytoplasmic and cytoplasmic-genic, Exploitation in monocots and dicots, difficulties in exploiting CGMS systems in dicots- Case studies and breeding strategies; Nucleocytoplasmic interactions with special reference to male sterility- Genetic, biochemical and molecular bases.				15
III	Population formation by hybridization-Types of population-Mendelian population, gene pool, composites, synthetics etc; Principles and procedure in the formation of a complex population; Genetic basis of population improvement.				10
IV	Selection in self-fertilizing crops; Creation of genetic variability; Selection methods: mass selection, pureline selection, pedigree method (selection in early generations vs advance generations); back cross, poly cross and test cross.				10
V	Selection in cross-fertilizing crops – poly cross and top cross selection, mass and recurrent selection methods and their modifications : grided mass selection, ear to row selection, convergent selection, divergent selection , Recurrent selection : simple recurrent selection and its modification (restricted phenotypic selection , selfed progeny selection and full sib recurrent selection) ,Recurrent selection for general combining ability- concepts and utilization. Recurrent selection for specific combining ability – usefulness in hybrid breeding programmes, Reciprocal recurrent selection ( Half sib reciprocal recurrent selection, Half sib reciprocal recurrent selection with inbred tester and Full sib reciprocal recurrent selection); selection in clonally propagated crops – Assumptions and realities.				15
	Practical				
	Floral biology in self and cross pollinated species, selfing and crossing techniques. Selection methods in segregating populations and evaluation of breeding material; Analysis of variance (ANOVA); Estimation of heritability and genetic advance; Maintenance of experimental records; Learning techniques in hybrid seed production using male-sterility in field crops.				30
Suggested readings including digital platforms		<ul style="list-style-type: none"><li>• Agarwal RL. 1996. <i>Fundamentals of Plant Breeding and Hybrid Seed Production</i>. Oxford &amp; IBH.</li><li>• Allard RW. 1966. <i>Principles of Plant Breeding</i>. John Wiley &amp; Sons.</li><li>• Briggs FN &amp; Knowles PF. 1967. <i>Introduction to Plant Breeding</i>. Reinhold.</li><li>• Hayes HK, Immer FR &amp; Smith DC. 1955. <i>Methods of Plant Breeding</i>. McGraw-Hill.</li><li>• Mandal AK, Ganguli PK &amp; Banerji SP. 1995. <i>Advances in Plant Breeding</i>. Vol. I, II. CBS.</li><li>• Richards AJ. 1986. <i>Plant Breeding Systems</i>. George Allen &amp; Unwin.</li><li>• Sharma JR. 1994. <i>Principles and Practice of Plant Breeding</i>. Tata McGraw-Hill.</li><li>• Simmonds NW. 1979. <i>Principles of Crop Improvement</i>. Longman.</li><li>• Singh BD. 1997. <i>Plant Breeding: Principles and Methods</i>. 5 Ed., Kalyani.</li><li>• Singh P. 1996. <i>Essentials of Plant Breeding</i>. Kalyani.</li><li>• Singh P &amp; Narayanan SS. 1993. <i>Biometrical Techniques in Plant Breeding</i>. Kalyani.</li><li>• Welsh JR. 1981. <i>Fundamentals of Plant Genetic and Breeding</i>. John Wiley.</li><li>• Williams W. 1964. <i>Genetical Principles and Plant Breeding</i>. Blackwell.</li></ul>			



Name of the Subject: Genetics and Plant Breeding					
Course/ paper code:	GPB-603	Course/ paper title:	Research methodology, Statistics and Computer Application.	Credit assigned	4(3+1)
Type of course	Compulsory	Semester	I		
Unit	Topic (Theory)				M. L.
I	Meaning, objectives, concepts and scope of research in Indian agriculture, Types, criteria, process of research and characteristics of good research. Selection of problem and review of literature, hypothesis- their meaning, types, characteristics and testing of hypothesis. Major problems encountered in the area of agricultural research in India.				10
II	Formulation and identification of research in Agriculture. Basic concepts and principles of experimental design i.e. CRD, RBD, LSD, Factorial design. Augmented design, split plot design and missing plot technique. Features of a good design.				10
III	Collection, classification, tabulation and analysis of data by measures of central tendencies, diepersions, coefficient of correlations and regressions and different test i.e. Z, F, t and "Chi square" (X <sup>2</sup> ) interpretations of analyzed data and preparations of reports and thesis.				5
IV	Sample survey vs complete enumeration, probability sampling, sample space, sampling design, sampling strategy; Determination of sample size; Confidence- interval; Simple random sampling, Estimation of population proportion, Stratified randomsampling,Proportionalallocationandoptimalallocation,Inversesampling.				5
V	Ratio, Product and regression methods of estimation, Cluster sampling, Systematic sampling, Multistage sampling with equal probability, Separate and combined ratio estimator, Double sampling, Successive sampling –two occasions.				5
VI	<b>Computer Application:</b> Basic Knowledge of Computer, use of computer in the research, Data Analysis Software and Analysis Techniques, use of multimedia tools, use of MS Office, preparation of Power Point Presentations, use of Internet for Research Purpose, Introduction to UGC infonet, INFLIBNET and ERNET etc.				5
VII	<b>Scientific conduct:</b> Ethics with respect to science and research, intellectual honesty and research integrity, Scientific misconducts- falsifications, fabrications and plagiarism (FFP) Redundant publications: duplicate and overlapping publications, salami slicing; selective reporting and misrepresentation of data. Publication ethics: Definition, introduction and importance. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, type, violation of publication ethics, authorship and contributorship. Software tools: use of plagiarism software like Turnitin, Urkund and other open-source software tools.				5
	<b>Practical</b>				
	Analysis of data obtained from CRD, RBD, LSD, Analysis of factorial experiments, Analysis with missing data, Split plot and strip plot designs.				15
<b>Suggested readings including digital platform</b>		<ul style="list-style-type: none"><li>Chandel, SRS (2007) "A Handbook of Agricultural Statistics."Achal Prakashan Mandir, Pandu Nagar , Kanpur.</li><li>Dhondhiyal, S.P.(1994) Social science research and thesis writing. Shiwani press, Vishnupuri, Kanpur.</li><li>Kothari, C.R. (1999) Research methodology, Methods and technique. Wishwa prakashan, New Delhi.</li><li>Panse,V.G. and Sukhatme, P.V. (1967) Statistical methods for agricultural workers. IInd edn. ICAR, New Delhi.</li><li>Rangaswami, R. (2010) A text book of agricultural statistics. New Age Publications, New Delhi.</li></ul>			