VEER BAHADUR SINGH PURVANCHAL UNIVERSITY, JAUNPUR
(UTTAR PRADESH)

SYLLABUS
OF
PRE-Ph.D. COURSE WORK AS PER NEP-2020 GUIDELINES

SUBJECT: Genetics and Plant Breeding

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Convener	Member	External Expert	External Expert

Veer Bahadur Singh Purvanchal University, Jaunpur (U.P.)

Syllabus of Pre-Ph.D. course work

As per NEP-2020 guidelines

With effective from **academic session 2022-23**

Subject prerequisites: To study the subject- Genetics and Plant Breeding

Programme outcomes (POs): Students will able to get the thorough knowledge about the genetic architecture of crop plant, genome analysis technique and procedures to develop the high yielding crop varieties.

PO1: Students will be able to establish the plant genome mapping, genome sequencing principles and techniques, etc.

PO2: Students will be able to develop the hybrid varieties; understand the inheritance, nature and magnitude of gene action in crop plants, etc.

PO3: Students will be able to familiar with issues related to the genetics and plant breeding in relation to enhance the crop productivity.

Programme specific outcomes (PSOs): Genetics and Plant Breeding-I & II.

PSO1: Students will be able to get knowledge related to the selection in self and cross-pollinating crops, biometrical technique in plant breeding, etc.

PSO2: Students will be able to get knowledge related to genomes concept and complexity C-value paradox, repetitive and unique DNA.

PSO3: Students will be able to describe and explain the concepts of analysis of genotype x environment interaction - adaptability and stability; Models for GxE analysis and stability parameters.

List of all papers of Pre-Ph.D. course work or Post graduate diploma in Research (PGDR)

Year	Sem	Course Code	Course Title	Theory/ Research	Credit	Max. Marks
7	XIII	D0201301T	Advances in plant breeding systems and biometrical genetics	Theory	6	100 [25(CIE)+75(UE)]
		D0201302T	Population genetics, genomics and plant genetic resources	Theory	6	100 [25(CIE)+75(UE)]
		D0201303T	Research Methodology, Research Publication Ethics and Computer Applications	Theory	4	100 [25(CIE)+75(UE)]
		D0201304R	Research Project	**Research**	-	100 [25(CIE)+75(UE)]

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Credit system:

- A four (4) credit theory course/paper will have four Lectures/periods (of one hour) in a week. In one full semester the course will be covered in 60 Lectures.
- Similarly, a six (6) credit theory course/paper will have six Lectures/periods (of one hour) in a week. In one full semester the course will be covered in 90 Lectures.

Continuous Internal Evaluation (CIE) of 25 marks:

- Continuous internal evaluation will be performed by the teacher/ course coordinator concerned.
- CIE shall be 25% of total assessment in a Theory paper and research project.
- 25 marks shall be distributed as 5 marks for attendance, 5 marks for presentation and assignment and remaining 15 marks for class test.

Marking system:

- All papers will have a total maximum mark of 100, including both CIE and University Examination (UE).Maximum marks of 25 will be allotted to CIE and 75 to UE in a theory paper/ research project.
- The CIE of the research project shall be evaluated by the research supervisor and co-supervisor (if any).
- 75 marks of **research project** shall be distributed as 50 marks (project work and presentation) and a viva voce of 25 marks.
- The evaluation (Max Marks 75 UE) of the research project shall be done by internal examiner/s (Supervisor and Co-supervisor (if any)) and one external examiner appointed by the University.

Research Project Submission:

- The evaluated research project report in two sets of hard copy (spiral binding) must be prepared. One copy of it shall be submitted to the university if it demands. A second copy of the evaluated research project report must be in the records of the college/research centre.
- The format of university Ph.D. thesis writing guidelines can be used as format of Research project writing guidelines.

Programme: Post graduate diploma in Research (PGDR)	**Year: seven (**7)	**Semester:** XIII
Subject: Genetics and Plant Breeding		
Course Code: D0201301T	**Course Title:** Advances in plant breeding systems and biometrical genetics	

Course Outcomes (COs)

CO1: Students will be able to get knowledge related to Principles and methodology for Self and cross pollinated Crops

CO2: Students will be able to understand the techniques of hybrid varieties development and biometrical techniques in plant breeding

CO3: Students will be able to develop QTL Mapping and strategies for QTL mapping.

Credits: 6	**Core Compulsory**
Max. Marks: 25 (CIE) + 75(UE)	**Min. Passing marks: 55**

Total number of lectures: Lectures-Tutorial-Practical (6 hours in a week) L-T-P: 6-0-0 **(90 hr#)**

Unit	Topics	No. of Lecture Hrs.
I	Principles and methodology for Self-pollinated Crops: Mendelian consequences of planned hybridization, pure line theory, sources of variation in pure line , pure line selection , mass selection Pedigree method, bulk, single seed decent method, multiline ,population approach and hybrid varieties.	**15**
II	Principles and methodology for Cross- pollinated crops: Genetic structure of cross pollinated crops, system of mating, population improvement methods, synthetic and composite varieties, heterosis and hybrid varieties.	**15**
III	Techniques of hybrid varieties development: Genetic engineering technology to create male sterility, prospects and problems, use of self- incompatibility and sterility in plant breeding. Conversion of agronomically ideal genotypes into male sterile concepts and breeding strategies. Environmentally induced Genetic Male Sterility (EGMS)- types of EGMS, Photo and thermo sensitive genetic male sterility and its use in heterosis breeding. Temperature sensitivity genetic male sterility and its use in heterosis breeding. Apomixis and its use in heterosis breeding.	**18**
IV	Breeding for climate change: Breeding for abiotic stress, water stress, water use efficiency flooding and submergence tolerance, Salt tolerance, Biotic stresses : disease and insect pest resistance, Greenhouse gases and carbon sequestration breeding for bio- fortification.	**15**

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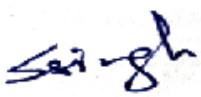
V	Biometrical techniques: Genetic diversity analysis - metroglyph, cluster and D^2 analyses - Association analysis - phenotypic and genotypic correlations; Path analysis and Parent - progeny regression analysis. Generation mean analysis, mating design -Diallel, partial Diallel, line x tester analysis, NCD and TTC, concept of combining ability and gene action. Analysis of genotype x environment interaction- adaptability and stability. Model for G X. E analysis and stability parameters.	**15**
VI	QTL Mapping and MAS: QTL Mapping, strategies for QTL mapping, mapping population, Types of marker, Markar Assisted Selection and factor affecting MAS.	**12**

 # One credit is equivalent to 15 lecture hours as per NEP norms in theory classes. Number of hours in each unit 15 hours may vary as per the content of the unit.

Suggested Readings:

1. Baxevanis AD & Ouellette BFF. 2001. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Wiley Interscience.
2. Brown TA. 2002. Genomes.
3. Galas DJ & McCormack SJ. 2002. Genomic Technologies: Present andFuture. Calster Academic Press.
4. Jordan BR. 2001. DNA Microarrays: Gene Expression Applications.Springer- Verlag.
5. Liu BH. 1997. Statistical Genomics: Linkage, Mapping and QTL Analysis.CRS Press.
6. Lynch M & Walsh B. 1998. Genetics and Analysis of Quantitative Traits.Sinauer Associates.
7. Mount DW. 2001. Bioinformatics. Sequence and Genome Analysis. ColdSpring Harbor Laboratory Press.
8. Palzkill T. 2002. Proteomics. Kluwer.Paterson AH. 1996. Genome Mapping in Plants. Academic Press.
9. Pennington SR & Dunn MJ. 2002. Proteomics: From Protein Sequence toFunction. Viva Books.
10. Rampal JB. 2001. DNA Arrays: Methods and Protocols. Humana Press.
11. Wiley-LISS.Caetano-Anolles G & Gresshoff PM. 1998. DNA Markers: Protocols, Applications and Overviews.
12. Wiley-VCH.Cantor CR & Smith CL (2004). Genomics. Wiley, New York.





1. https://www.genome.gov/about-genomics/fact-sheets/A-Brief-Guide-to-Genomics

2. https://www.routledge.com/Genomics-Fundamentals-and-Applications
3. https://core.ac.uk/download/pdf/211011238.pdf
4. https://www.mdpi.com/2073-4395/10/3/439

Programme: Post graduate diploma in Research (PGDR)	**Year: Seven (7)**	**Semester:** XIII
Subject: Genetics and Plant Breeding		
Course Code: D0201302T	**Course Title:** Population genetics, genomics and plant genetic resources.	

Course Outcomes (COs)

CO1: Students will be able to understand the facts about the mandelian population, frequency of genes and genotypes and how to estimate the linkage disequilibrium.

CO2: Students will be able to apply the principles and techniques of conventional approaches of genome sequencing during research.

CO3: Students will be able understand the knowledge base of plant genetic resources and its conservation.

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Credits: 6	**Core Compulsory**
Max. Marks: 25 (CIE) + 75(UE)	**Min. Passing marks: 55**

Total number of lectures: Lectures-Tutorial-Practical (6 hours in a week) L-T-P: 6-0-0 **(90 hr#)**

Unit	Topics	No. of Lecture Hrs.
I	Population: general consideration: Properties of population, mendelian population, frequency of genes and genotypes, causes of changes: population size, differences in fertility and viability, migration and mutation.	**15**
II	Hardy -Weinberg equilibrium. Hardy -Weinberg law, mating systems, random mating population, non random mating: self-inbreeding coefficient. Sib mating, Assortative mating and disassortative mating. Estimation of linkage disequilibrium.	**15**
III	Genomics: Introduction Introduction of plant genome: nuclear, chloroplast and mitochondrial genomes concept of genome size and complexity C-	**15**

	value paradox, repetitive and unique DNA.	
IV	Genom sequencing: Principles and techniques of conventional approaches and next generation sequencing. Recent transgen free genome editing tools such as CRISPR-Cas 9 system, TALENS and ZFNs for crop improvement.	**15**
V	Plant Genetic Resources: Biodiversity and its conservation, concepts of natural reserves and natural gene banks. In-situ conservation of wild species. Ex-situ conservation: components, plant genetic resource conservation in gene banks, National gene banks.	**15**
VI	In- vitro storage and cryopreservation of germplasm. Concept and procedure for PGR management, germplasm characterization, evaluation and utilization, collections and registration of plant germplasm.	**15**

 # One credit is equivalent to 15 lecture hours as per NEP norms in theory classes. Number of hours in each unit 15 hours may vary as per the content of the unit.

Suggested Readings:

1. Agarwal RL. 1996. Fundamentals of Plant Breeding and Hybrid SeedProduction. Oxford &IBH.
2. Allard RW. 1966. Principles of Plant Breeding. John Wiley & Sons.
3. Briggs FN & Knowles PF. 1967. Introduction to Plant Breeding. Reinhold.
4. Fehr WR. 1987. Principles of Cultivar Development: Theory and Technique. Vol I. Macmillan.
5. Hayes HK, Immer FR & Smith DC. 1955. Methods of Plant Breeding. McGraw- Hill.
6. Falconer DS & Mackay J. 1998. Introduction to Quantitative Genetics. Longman. Mandal AK, Ganguli PK & Banerji SP. 1995. Advances in Plant Breeding. Vol. I, II. CBS.
7. Mather K & Jinks JL. 1971. Biometrical Genetics. Chapman & Hall.
8. Mather K & Jinks JL. 1983. Introduction to Biometrical Genetics. Chapman & Hall.
9. Nadarajan N & Gunasekaran M. 2005. Quantitative Genetics and Biometrical Techniques in Plant Breeding. Kalyani.
10. Naryanan SS & Singh P. 2007. Biometrical Techniques in Plant Breeding. Kalyani.
11. Richards AJ. 1986. Plant Breeding Systems. George Allen & Unwin.
12. Sharma JR. 1994. Principles and Practice of Plant Breeding. TataMcGraw-Hill. Simmonds NW. 1979. Principles of Crop Improvement. Longman.
13. Singh BD. 1997. Plant Breeding: Principles and Methods. 5 Ed., Kalyani. Singh P. 1996. Essentials of Plant Breeding. Kalyani.

14. Singh P & Narayanan SS. 1993. Biometrical Techniques in Plant Breeding. Kalyani.
15. Singh RK & Choudhary BD. 1987. Biometrical Methods in QuantitativeGenetics. Kalyani.
16. Welsh JR. 1981. Fundamentals of Plant Genetic and Breeding. John Wiley. Williams W. 1964. Genetical Principles and Plant Breeding. Blackwell.

- **https://www** http://www.springer.com/us/book/9783319225203
- https://www.cabidigitallibrary.org/doi/book/10.1079/9780851996011.0000
- https://onlinelibrary.wiley.com/doi/book/10.1002/9781118313718

Programme: Post graduate diploma in Research (PGDR)	**Year: seven (7)**	**Semester:** XIII
Subject: Genetics and Plant Breeding		
Course Code: D0201303T	**Course Title:** Research Methodology, Research Publication Ethics and Computer Applications	

Course Outcomes (COs)

CO1: With the help of this course, students will be able to decide the research field, topic, design, and pros and cons of research, sampling, and data collection techniques.

CO2: The student will be able to understand the research process and acquire the skill of writing research articles.

CO3: The course will enable you to execute the best practices, morals, and ethical values in scientific conduct and avoid publication misconduct.

CO4: With the help of this course, students will be able to learn about the standards of journals for good-quality publications of their research work.

CO5: After this course, the students will be able to learn how to use computers and different application software for manuscript writing.

CO6: This course will enable the students to learn about reference management and the maintenance of academic integrity using scientific tools. They will be familiar with the protection of the machines from computer hazards.

Credits: 4	**Core Compulsory**
Max. Marks: 25 (CIE) + 75(UE)	**Min. Passing marks: 55**

Total number of lectures: Lectures-Tutorial-Practical (4 hours in a week) L-T-P: 4-0-0 **(60 hr)**

Unit	Topics	No. of Lecture Hrs.
I	**Research Methodology** Definition, and Objectives, Motivation and Significance of Research, Types of Research, Truth and Facts of Research, Similarity and Contrast in Literary Research and Scientific Research, Research and Criticism, Research Problem and Research	12

	Design, Sampling Design and Methods of Data Collection.	
II	**Research standards:** Layout of the Research Report, Research Process: subject Selection, Outline of the Research, Review of Literature, Material Collection; Testing and Classification, Analysis, Discussion and Conclusions, Precautions in Writing Synopsis/Research Paper/Thesis/Research Report.	**12**
III	**Philosophy, Ethics, Scientific Conducts and misconduc** Moral Philosophy, Nature of Moral Judgments and Reactions, Publication Ethics, Best Practices/Standards Setting Initiatives and Guidelines: Committee on Publication Ethics (COPE), World Association of Medical Editors (WAME) etc., Intellectual Honesty and Research Integrity: Falsification, Fabrication and Plagiarism (FFP), Open Access Publishing, and Publication Misconduct.	**08**
IV	**Databases and Research Metrics** Databases: Indexing Databases, Citation Databases: Web of Science, Scopus etc., Research Metrics: Impact Factor of Journal as Per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-Index, g-Index, i-10 Index, and Altimetric.	**08**
V	**Fundamentals of Computers and application Softwares** Types Of Computers, Computer Peripherals andinternalcomponent, Types of Operating Systems, Web Browser, Web Search Engine, Spreadsheet Processing, Presentation (MS PowerPoints Preparation or Beamer or Libre Office (Optional), Project/Thesis/Report writing, Using MS-Word or LaTeX or LibreOffice documentation style Labelling, References Style, Footnotes etc.	**12**
VI	**Scientific Softwares** Use of Reference Management Software Like Mendeley, Zotero, Reference Manager, Endnote, Authorea Etc. Anti-Plagiarism Software Like Turnitin, iAuthenticate, Urkund, Ebooks and Virtual Library, UGC-Infonet, Computer Hazards and Security	**08**

Suggested Readings:

1. C.R. Kothari, *Research methodology Methods and Techniques*, 4th Edition, New Age International (P) Ltd. Publisher, 2014.
2. W. Creswell, *Research Design, Qualitative, Quantitative and mixed method approaches*, 3rd Edition, Sage Publications, Inc.
3. D.B. Resnik, (2011) What is ethics in research & Why is it important. National institute of Environmental Health Science, 1-10 Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm
4. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-81-939482-1-7. https://www.insaindia.res.in/pdf/Ethics_Book.pdf
5. Reema Thareja (2019) Fundamentals Of Computers (2nd Edition), Oxford University Press
6. Microsoft Office 365 : A complete Guide to Master Word, Excel, and PowerPoint 365 for Beginners, Matt Vic
7. Leslie Lamport, LaTeX, A Document Preparation System, 2nd Edition, Addison-Wesley Professional Publisher, July, 1994.
8. Latex tutorials https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf
9. Libre Office tutorial: www.documentation.libreoffice.org/en/english-documentation

Suggested equivalent online courses: https://epgp.inflibnet.ac.in/

Programme: Post graduate diploma in Research (PGDR)	**Year: Seven (7)**	**Semester:** XIII
Subject: Genetics and Plant Breeding		
Course Code: D0201304R	**Course Title: Research Project**	
Course Outcomes (COs) CO1: Student will able to know how to write review of literature, references, data analysis, experimental design implementation, etc. CO2: Student will able to write review paper, research paper, popular article, etc for the publications consideration in national and international journals.		
Credits: Non -Credit	**Core Compulsory**	
Max. Marks: 25 (CIE) + 75(UE)	**Min. Passing marks: 55**	

Suggested Readings:

http://ecourses.icar.gov.in.
http://www.apsnet.org
http://ecoursesonline.iasri.res.in

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Convener	Member	External Expert	External Expert

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