

**Integral University, Lucknow**  
**Integral Institute of Agricultural Science and Technology (IIAST)**  
**Evaluation Scheme of Post graduate program**  
**M. Sc. (Ag.) Genetics and Plant Breeding**  
**w.e.f. Session 2018-19**

**Semester – II**

Course Code	Subject	Type of Course	Periods/ Per week			Evaluation Scheme Theory Mid Sem			Evaluation Scheme Practical Mid Sem			Practical End Sem Exam	Sub Total (Theory + Practical Mid Sem Exam)	End Sem Theory Exam	Subject Total	Credit	Total Credit Points
			L	T	P	CT	TA	Total	CT	TA	Total						
APG511	Principles of Plant Breeding	Core courses (Compulsory)	2	0	0	20	10	30	-	-	-	0	0	70	100	2:0:0	2
APG513	Principles of Quantitative Genetics		2	0	2	20	10	30	-	-	-	20	50	50	100	2:0:1	3
APG514	Methods of Plant Breeding		2	0	2	20	10	30	-	-	-	20	50	50	100	2:0:1	3
<b>Total</b>																	
			Optional Courses														
<b>Total</b>																	*
<b>*Major Course (Core course + Optional course) should not exceed more than 9 credit</b>																	
APA520	Agronomy of Major Field Crop (Rabi)	Minor/ Related/ Supporting courses	3	0	0	20	10	30	-	-	-	-	30	70	100	3:0:0	3
AG512	Breeding of Vegetable Crops		2	0	2	20	10	30	-	-	-	20	50	50	100	2:0:1	3
<b>Total</b>																	**
PGS502	Technical Writing and Communications Skills	Non Credit Course (Compulsory)	0	0	2	0	0	0	-	-	-	25	75	0	100	0:0:1	1 <sup>#</sup>
PGS505 (e-Course)	Agricultural Research, Research Ethics and Rural Development Programmes		1	0	0	20	10	30	-	-	-	0	0	70	100	1:0:0	1 <sup>#</sup>
PGS506 (e-Course)	Disaster Management		1	0	0	20	10	30	-	-	-	0	0	70	100	1:0:0	1 <sup>#</sup>
APG591	M.Sc. (Ag.) Seminar		-	-	-	-	-	-	-	-	-	-	-	-	100	0:0:1	1
APG599	M.Sc. (Ag.) Research		-	-	-	-	-	-	-	-	-	-	-	-	S/US	0:0:3	3 <sup>\$</sup>
<b>Grand Total</b>																	
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*Grand Total \*\*\* = \*+\*\*, credit should not exceed more than 18 credit in one semester, <sup>#</sup>Non-Gradial Course, <sup>\$</sup>M.Sc. (Ag.) Research credit to be counted in Final Semester examinations, S/US=Satisfactory/Unsatisfactory*

**M.Sc. (Ag.) Genetics and Plant Breeding**  
**SEMESTER-II**  
**Syllabus: Principles of Plant Breeding**  
**Paper Code: APG511**  
**w.e.f. Session 2018-19**

**2(2+0)**

**Unit I**

Introduction to plant breeding-history, objectives, achievements in the pre-Mendelian era, Post-Mendelian plant breeding, potential and opportunities.

**Unit II**

Introduction, domestication and acclimatization, patterns of evolution in crop plants, centers of origin, gene pool concept- primary, secondary and tertiary gene pool, and gene introgression.

**Unit III**

Modes of reproduction in plants- asexual and sexual reproduction, self- and cross-pollination mechanisms, male-sterility and self-incompatibility. Mating systems- genotypic and phenotypic assortative and dis-assortative mating and their genetic consequences.

**Unit IV**

Genetic consequences of self and cross- fertilization. Heterosis and inbreeding depression - concepts and theories,

**Unit V**

Genetic basis of plant breeding; principles of mutation breeding, polyploidy and distant hybridization in plant breeding. Mechanisms and genetic basis of resistance/tolerance to biotic and abiotic stresses.

**Suggested Readings:**

1. Singh BD. 2006. Plant Breeding. Kalyani Publishers
2. Singh P. 2006. Essentials of Plant Breeding. Kalyani Publishers
3. Singh S & Pawar IS. 2006. Genetic Bases and Methods of Plant Breeding. CBS.
4. Chopra VL. 2004. Plant Breeding. Oxford & IBH.
5. Roy D. 2003. Plant Breeding, Analysis and Exploitation of Variation. Narosa Publ. House.
6. Singh P. 2002. Objective Genetics and Plant Breeding. Kalyani Publishers
7. Sharma JR. 2001. Principles and Practice of Plant Breeding. Tata McGraw-Hill.
8. Chopra VL. 2001. Breeding Field Crops. Oxford & IBH.
9. Simmonds NW. 1990. Principles of Crop Improvement. English Language Book Society.
10. Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons.

**M.Sc. (Ag.) Genetics and Plant Breeding**  
**SEMESTER-II**  
**Syllabus: Principles of Quantitative Genetics**  
**Paper Code: APG513**  
**w.e.f. Session 2018-19**

3 (2+1)

**Unit I**

Historical background of quantitative genetics. Fixed and random effect models, Elementary concept of matrix theory, gene and genotypic frequency. Partitioning of mean and variance. Single gene and multiple gene models- estimation of genetic parameters and scaling tests.

**Unit II**

Linkage, epistasis, components and their estimation, co-variance between relatives. Inbreeding and heterosis-simple model, extension to polygenic situations. Mating designs (diallel, North Carolina, line x tester designs and triple test cross).

**Unit III**

Concept of combining ability and relevance to gene action. Heritability, selection differential and response to selection, correlated response, genotype x environment interaction, and stability analysis.

**Unit IV**

Selection indices, correlation and path coefficient, genetic divergence, principal component and discriminant analysis.

**Practical:** ANOVA for fixed and random effect model, mean and variance. in different populations (self, sib, backcross, F<sub>2</sub>) partitioning' of total genetic variance in various models, analysis in North Carolina Designs, diallele, TTC and LxT. Estimation of heritability, selection intensity, 'selection response. Correlation, regression, path coefficient and multivariate analysis. Use of computer packages.

**Suggested Readings:**

1. Naryanan SS & Singh P. 2007. Biometrical Techniques in Plant Breeding. Kalyani Publishers
2. Nadarajan N & Gunasekaran M. 2005. Quantitative Genetics and Biometrical Techniques in Plant Breeding. Kalyani Publishers
3. Falconer DS & Mackay J. 1998. Introduction to Quantitative Genetics. Longman
4. Singh P & Narayanan SS. 1993. Biometrical Techniques in Plant Breeding. Kalyani Publishers
5. Singh RK & Choudhary BD. 1987. Biometrical Methods in Quantitative Genetics. Kalyani Publishers
6. Mather K & Jinks JL. 1983. Introduction to Biometrical Genetics. Chapman & Hall.
7. Mather K & Jinks JL. 1971. Biometrical Genetics. Chapman & Hall.

**M.Sc. (Ag.) Genetics and Plant Breeding**  
**SEMESTER-II**  
**Syllabus: Methods of Plant Breeding**  
**Paper Code: APG514**  
**w.e.f. Session 2018-19**

2(1+1)

**Unit I**

Plant genetic resources: importance, collection, evaluation and conservation of germplasm. Methods of breeding self-pollinated, cross-pollinated and asexually propagated crops

**Unit II**

Pure line and mass selection; pedigree selection, bulk method and modification of these methods; hybrid breeding, populations and population improvement, intra and inter-population; clonal selection.

**Unit III**

Mutation breeding, use of polyploidy and distant hybridization plant breeding. Application of biotechnology to plant breeding - embryo rescue, somaclonal variation, double haploidy, protoplast fusion, transgenics

**Unit IV**

Molecular plant breeding, biosafety issues involved with genetically modified organisms. Release and registration of new varieties, quality seed - classes, production practices and maintenance of pure seed, seed purity standards, UPO convention and convention on biodiversity.

**Practical:** Floral biology in self and cross-pollinating crop species; selfing and crossing techniques in major field crops; determination of extent of out-crossing, male sterility- detection and maintenance; self incompatibility and techniques of maintenance and overcoming sporophytic and gametophytic 'incompatibility'; selection methods in segregating populations, selection differential and intensity - demonstration of their relationship and effect on genetic gain; Evaluation of breeding material, screening for quality traits, resistance/tolerance to biotic and abiotic stress; demonstration of quality seed production through nucleus and breeding seed production techniques.

**Suggested Readings:**

1. Singh BD. 2006. Plant Breeding. Kalyani Publishers
2. Singh P. 2006. Essentials of Plant Breeding. Kalyani Publishers
3. Singh S & Pawar IS. 2006. Genetic Bases and Methods of Plant Breeding. CBS
4. Chopra VL. 2004. Plant Breeding. Oxford & IBH.
5. Roy D. 2003. Plant Breeding, Analysis and Exploitation of Variation. Narosa Publ. House.
6. Singh P. 2002. Objective Genetics and Plant Breeding. Kalyani Publishers
7. Sharma JR. 2001. Principles and Practice of Plant Breeding. Tata McGraw-Hill.
8. Chopra VL. 2001. Breeding Field Crops. Oxford & IBH.
9. Simmonds NW. 1990. Principles of Crop Improvement. English Language Book Society.
10. Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons.

**M.Sc. (Ag.) Genetics and Plant Breeding**  
**SEMESTER-II**  
**Syllabus: Agronomy of Major Field Crops (Rabi)**  
**Paper Code: APA520**  
**w.e.f. Session 2018-19**

**3(3+0)**

**Unit I**

Origin, history, distribution, adaptation, classification, morphology, phenology, physiology, Varietal improvement and production technology of Wheat, Barley, Chickpea, Peas, Lentil, Rajmash

**Unit II**

Origin, history, distribution, adaptation, classification, morphology, phenology, physiology, Varietal improvement and production technology of Rapeseed and Mustard, Linseed, Safflower, Tara mira, Potato, Tobacco and Sugar Beet

**Unit III**

Quality components and industrial uses of the main and by- products and their post harvest handling for marketing

**Suggested Readings:**

1. Das NR. 2007. Introduction to Crops of India. Scientific Publ.
2. Kumar Ranjeet & Singh NP. 2003. Maize Production in India: Golden Grain in Transition. IARI, New Delhi.
3. Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR.
4. Khare D & Bhale MS. 2000. Seed Technology. Scientific Publ.
5. Hunsigi G & Krishna KR. 1998. Science of Field Crop Production. Oxford & IBH.
6. Pal M, Deka J & Rai RK. 1996. Fundamentals of Cereal Crop Production. Tata McGraw Hill.

**M.Sc. (Ag.) Genetics and Plant Breeding**  
**SEMESTER-II**  
**Syllabus: Breeding of Vegetable Crops**  
**Paper Code: AG512**  
**w.e.f. Session 2018-19**

3(2+1)

**Theory**

Origin, botany, taxonomy, cytogenetics, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, molecular marker, genomics, marker assisted breeding and QTLs, biotechnology and their use in breeding in vegetable crops-Issue of patenting, PPVFR act.

**Unit I**

Potato and tomato

**Unit II**

Eggplant, hot pepper, sweet pepper and okra

**Unit III**

Peas and beans, amaranth, chenopods and lettuce

**Unit IV**

Gourds, melons, pumpkins and squashes

**Unit V**

Cabbage, cauliflower, carrot, beetroot, radish, sweet potato and tapioca

**Practical:** Selection of desirable plants from breeding population observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations; induction of flowering, palanological studies, selfing and crossing techniques in vegetable crops; hybrid seed production of vegetable crops in bulk. Screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops, demonstration of sib-mating and mixed population; molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques. Visit to breeding blocks.

**Suggested Readings:**

1. Peter KV & Pradeepkumar T. 2008. Genetics and Breeding of Vegetables. Revised, ICAR.
2. Rai N & Rai M. 2006. Heterosis Breeding in Vegetable Crops. New India Publ. Agency.
3. Dhillon BS, Tyagi RK, Saxena S. & Randhawa GJ. 2005. Plant Genetic Resources: Horticultural Crops. Narosa Publ. House.
4. Singh PK, Dasgupta SK & Tripathi SK. 2004. Hybrid Vegetable Development. International Book Distributing Co.
5. Fageria MS, Arya PS & Choudhary AK. 2000. Vegetable Crops: Breeding and Seed Production. Vol. I. Kalyani.
6. Allard RW. 1999. Principles of Plant Breeding. John Wiley & Sons.
7. Kalloo G. 1998. Vegetable Breeding. Vols. I-III (Combined Ed.). Panima Edu. Book Agency.
8. Paroda RS & Kalloo G. (Eds.). 1995. Vegetable Research with Special Reference to Hybrid Technology in Asia-Pacific Region. FAO.
9. Kumar JC & Dhaliwal MS. 1990. Techniques of Developing Hybrids in Vegetable Crops. Agro Botanical Publ.

**M.Sc. (Ag.) Genetics and Plant Breeding**  
**SEMESTER-II**  
**Syllabus: Technical Writing and Communications Skills**  
**Paper Code: PGS502**  
**w.e.f. Session 2018-19**

**1(0+1)**

**Practical: Technical Writing** - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article. **Communication Skills** - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

**Suggested Readings**

1. Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.
2. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek.
3. Mohan K. 2005. Speaking English Effectively. MacMillan India.
4. Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
5. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
6. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
7. Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
8. Collins' Cobuild English Dictionary. 1995. Harper Collins.
9. James HS. 1994. Handbook for Technical Writing. NTC Business Books.
10. Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston.
11. Richard WS. 1969. Technical Writing. Barnes & Noble.

**M.Sc. (Ag.) Genetics and Plant Breeding  
SEMESTER-II**

**Syllabus: Agricultural Research, Research Ethics and Rural Development Programmes (e-Course)**

**Paper Code: PGS505  
w.e.f. Session 2018-19**

**1(1+0)**

**Unit I**

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centers (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

**Unit II**

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

**Unit III**

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

**Suggested Readings:**

1. Bhalla GS & Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ.
2. Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.
3. Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.
4. Singh K. 1998. Rural Development - Principles, Policies and Management. Sage Publ.

**M.Sc. (Ag.) Genetics and Plant Breeding**  
**SEMESTER-II**  
**Syllabus: Disaster Management (e-Course)**  
**Paper Code: PGS506**  
**w.e.f. Session 2018-19**

**1(1+0)**

**Unit I**

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion.

**Unit II**

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

**Unit III**

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

**Suggested Readings:**

1. Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.
2. Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management. Routledge.
3. Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.