



**Faculty of Agricultural Sciences (IAS)
Siksha 'O' Anusandhan, Deemed to be University**

M. Sc. (Ag.) in Plant Breeding and Genetics

Programme Outcome:

- Enriched knowledge on recent developments in soil and crop management with respect to improvement and productivity, water and nutrient management and their interaction with integrated approach and the disease and pest management in integrated manner. The economic indices on package of practices develop and their transfer to farmers makes the students eligible for advanced studies at doctoral level.
- With specialized knowledge in a particular discipline of agricultural sciences, the students are worth to be absorbed in different fields of academics, research and extension under different organizations.
- Agriculture being the applied science, the skills as developed in the fields of crop improvement, crop production, crop protection and social science fields makes the students an asset for taking up the assignments both at organizational and field level.
- The knowledge, skill and expertise gained during the `study of course curriculum provides an opportunity to take up entrepreneurships holistically as a joint venture.

Programme Specific Objectives:

- 1) Imparting knowledge on the fundamental aspects of genetics, plant breeding and their applications in crop improvement.
- 2) Knowledge on basic plant biotechnological methods viz., tissue culture, transgenics and marker assisted breeding
- 3) Imparting knowledge on the use of genetic resources for developing suitable crop varieties to face the changing agro-climatic situations
- 4) Inculcate research ethics, methodology and execution capability among the students to take up the responsibility in the field of Plant Breeding as a Researcher
- 5) To develop practical knowledge and skill among the students in order to make them the future entrepreneur in seed industry

Programme Specific Outcomes:

- 1) Enhancing fundamental knowledge and developing problem-solving skills pertaining to classical genetics, cytogenetics, plant breeding, biometrical genetics and molecular genetics.
- 2) Knowledge on biotechnological and other modern technologies used for crop improvement makes the students eligible for advanced studies at doctoral level.
- 3) With specialized knowledge in genetics and plant breeding, the students are worth to be absorbed in the fields of academics and research under different organizations dealing with crop improvement.
- 4) With the practical knowledge, skill and expertise of various crop improvement procedures, students can be the future entrepreneur in the field of tissue culture, seed industry etc.

***PBG 501: PRINCIPLES OF GENETICS (2+1)**

Objective:

The course is aimed at understanding the basic concept of genetics and helping students to develop their analytical, quantitative and problem solving skills from classical to molecular genetics.

Outcome:

- Knowledge on the basic principles of heredity and variation.
- Understanding on genomics and proteomics, mutation and gene expression.
- Development of analytical, quantitative and problem solving skills from classical to molecular genetics.
- Idea on DNA extraction and PCR amplification

***PBG 502: PRINCIPLES OF CYTOGENETICS (2+1)**

Objective:

The objective of this course is to provide insight into structure and function of chromosome, chromosome mapping, polyploidy and cytogenetics aspects of crop evolution.

Outcome:

- Knowledge on structure and functions of chromosomes, chromosome mapping
- Understanding the concepts of chromosomal aberrations and their application in crop breeding.
- Practical idea on fixation, dehydration, embedding, staining and observation of cell division.

***PBG 503: PRINCIPLES OF PLANT BREEDING (2+1)**

Objective:

The objective of this course is to impart theoretical knowledge and practical skills about various conventional and modern breeding methods for crop improvements.

Outcome:

- Understanding various modes of reproduction in crop plants and their genetic consequences.
- Idea on various breeding methods followed for development of superior cultivars.
- Practical knowledge on emasculation and hybridization techniques in both self & cross pollinated crops for development of hybrids.

***PBG 504: PRINCIPLES OF QUANTITATIVE GENETICS (2+1)**

Objective:

The objective of this course is to impart theoretical knowledge and computational skills regarding various biometrical methods used in plant breeding experiments to analyse and interpret quantitative data.

Outcome:

- Theoretical knowledge on various biometrical methods and tools.
- Use of various mating designs in field experiments.
- Development of analytical and problem solving skills on plant breeding experiments.

***PBG 505: CELL BIOLOGY AND MOLECULAR GENETICS (2+1)**

Objective:

The objective of this course is to impart knowledge in theory and practice about cell structure, organelles and molecules like proteins and nucleic acids.

Outcome:

- Knowledge on theory and practice about cell organelles and their functions, molecules like proteins and nucleic acids.
- Exposure to the concept of gene expression and their regulation in prokaryotes and eukaryotes
- Understanding of cell signalling.
- Quantitative estimation of DNA, RNA and protein in an organism

PBG 506: HETEROISIS BREEDING (1+1)

Objective:

The course is aimed at understanding the mechanisms of heterosis and its exploitation for yield improvement through conventional and biotechnological approaches.

Outcome:

- Understanding the mechanisms of heterosis and its exploitation for yield improvement.
- Use of male sterility and self-incompatibility in hybrid seed production.
- Exposure to 3-line, 2-line and 1-line system of hybrid seed production and development and maintenance of parental lines- A, B and R lines.
- Idea on commercial exploitation of heterosis.

PBG 507: GENE REGULATION AND EXPRESSION (2+0)

Objective:

Knowledge on recent advances in the phenomenon of gene regulation and mechanisms by which plants and microbes express through different traits and how these are modified during different stages.

Outcome:

- Idea on regulation of gene expression in both prokaryotes and eukaryotes.
- Knowledge on recent advances in the phenomenon of gene regulation and mechanisms,
- Insight into transgene expression and gene silencing mechanisms.

PBG 508: POPULATION GENETICS (1+1)

Objective:

The objective of this course is to impart knowledge on structure, properties and breeding values of different population.

Outcome:

- Knowledge on structure, properties and breeding values of different, population.
- Understanding the Hardy-Weinberg law - Proof – Applications
- Genetics exercise on probability, measurement of genotype and environment effect on phenotype

PBG 509: MUTAGENESIS AND MUTATION BREEDING (2+1)

Objective:

The objective of this course is to impart knowledge about mutation, mutagen, general principles of radiation and various tests/methods for detection of radiation effects on the living cells, genetic risks involved and perspective of advances made.

Outcome:

- Knowledge on general principles of radiation and various methods for detection, handling of mutagens, radiation hazards.
- Understanding the use of mutagens in creating oligogenic and polygenic variations – Case studies
- Exposure to the use of mutation for crop improvement.

PBG 510: GERMPLASM COLLECTION, EXCHANGE AND QUARANTINE (2+1)

Objective:

To provide information about collection, germplasm exchange, quarantine, maintenance and use of plant genetic resources including genetically modified plants.

Outcome:

- Knowledge on collection, germplasm exchange, quarantine, maintenance and use of plant genetic resources including genetically modified plants.
- Understanding the techniques for the detection of insects, mites, nematodes, bacteria, weeds, pathogens and viruses on seed and planting materials
- Exposure to the concepts of biosafety, risk analysis and consequences of spread of GE crops on the environment

PBG 511: BIOTECHNOLOGY FOR CROP IMPROVEMENT (2+1)

Objective:

The objective of this course is to impart knowledge and practical skills to use biotechnological tools in crop improvement.

Outcome:

- Getting acquainted with various types micro-propagation methods and their application in crop improvement.
- Idea on recombinant DNA technology and various methods of gene transfer.
- Exposure to the field of transgenics and their application in crop improvement.
- Knowledge on various types of marker systems and their application in crop improvement.

PBG 512: BREEDING FOR BIOTIC AND ABIOTIC STRESS RESISTANCE (2+1)

Objective:

To apprise about various abiotic and biotic stresses influencing crop yield, mechanisms and genetics of resistance and methods to breed stress resistance varieties

Outcome:

- Mechanisms and genetics of abiotic and biotic stresses resistance
- Exposure to various methods to breed stress resistant varieties.
- Phenotypic screening techniques, evaluating the available populations, use of MAS procedures, to combat biotic and abiotic stresses.

PBG 513: BREEDING CEREALS, FORAGES AND SUGARCANE (2+1)

Objective:

To provide insight into recent advances in improvement of cereals and forage crops and sugarcane using conventional and modern biotechnological approaches.

Outcome:

- Idea on evolution; Genetics – cytogenetics and genome relationship of important cereals, forages and sugarcane
- Knowledge on recent advances in improvement of cereals and forage crops and sugarcane using conventional and modern biotechnological approaches.
- Practical exposure to emasculation - pollination techniques, Standard Evaluation System

PBG 514: BREEDING LEGUMES, OILSEEDS & FIBRE CROPS (2+1)

Objective:

To provide insight into recent advances in improvement of legumes, oilseeds and fibre crops using conventional and modern biotechnological approaches.

Outcome:

- Idea on evolution, genetics – cytogenetics and genome relationship of important cereals, forages and sugarcane
- Knowledge on recent advances in improvement of legumes, oilseeds and fibre crops using conventional and modern biotechnological approaches.

- Practical exposure to emasculation – pollination techniques approaches,
- Idea on mechanism of resistance, evaluation techniques of germplasm

PBG 515: BREEDING FOR QUALITY TRAITS (2+1)

Objective:

To provide insight into recent advances in improvement of quality traits in cereals, millets, legumes, oilseeds and forage crops and for physiological efficiency using conventional and modern biotechnological approaches.

Outcome:

- Exposure to developmental biochemistry and genetics of carbohydrates, proteins, fats, vitamins, amino acids and anti-nutritional factors -
- Knowledge on quality improvement in important crops using conventional and modern biotechnological approaches
- Use of tissue culture for improving physiological efficiency, grain quality.

PBG 516: MAINTENANCE BREEDING AND CONCEPTS OF VARIETY RELEASE AND SEED PRODUCTION (1+1)

Objective:

To apprise the students about the variety deterioration and steps to maintain the purity of varieties and hybrids and principles of seed production in self and cross pollinated crops.

Outcome:

- Exposure to the techniques for maintaining the purity of varieties & hybrids,
- Idea on variety testing, release and notification systems in India and abroad.
- Knowledge on principles of seed production in self & cross pollinated crops.
- Idea on DUS testing- DUS Descriptors for major crops;

PBG 517: DATA BASE MANAGEMENT, EVALUATION AND UTILIZATION OF PGR (2+1)

Objective:

To provide information about germplasm data base management using modern tools and softwares, basics of computer and operating systems, Statistical techniques, evaluation procedure and experimental protocols, characterization of germplasm; molecular markers

Outcome:

- Idea on germplasm data base management using modern tools and softwares,

- Exposure to basics of computer and operating systems, Statistical techniques, Evaluation procedure and experimental protocols,
- Knowledge on techniques of germplasm characterization and use of Molecular markers in characterization.

PBG- 591: Maters seminar 1(0+1)

Objectives:

To develop capacity among the students to select research topic on important issues, preparation of power point covering the topic in different subheads, presentation style, eloquence and to develop ability to answer the questions.

Outcomes:

The students can select topic of research on emerging and important issues and present on powerpoint.

PBG- 599: Maters research 20(0+20)

Objectives:

To expose the students on research methodology, selection of researchable issues, preparation of synopsis and execution of programme following suitable experiment design

Outcomes:

Students can select a research topic, prepare synopsis and execute the programme as per suitable design.

PP 503: PHYSIOLOGICAL AND MOLECULAR RESPONSES OF PLANTS TO ABIOTIC STRESSES 3(2+1)

Objective

To apprise the students regarding abiotic stress to plant and its molecular basis.

Outcome: 1. Knowledge on physiological and molecular responses to various abiotic stresses.

2. Study of different physiological processes and molecular responses to stress.

3. Measurement and screening of stress parameters and behaviour towards tolerance.

STAT-510: EXPERIMENTAL DESIGNS 2+1

Objective

- I. This course is meant for students of agricultural and animal sciences other than Statistics.
- II. Designing an experiment is an integrated component of research in almost all sciences.
- III. The students would be exposed to concepts of Design of Experiments.

Outcome

- I. It will enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.
- II. The knowledge of design will significantly affect about pair-wise comparison of treatments.
- III. The inference about certain treatment from the pair-wise comparison will cost less with more output.
- IV. Varietal development leads for job creation.

STAT-513(2+1): DATA ANALYSIS USING STATISTICAL PACKAGES

Objective

- I. This course is meant for exposing the students in the usage of various statistical packages for analysis of data.
- II. It would provide the students an hands on experience in the analysis of their research data. This course is useful to all disciplines.

Outcome

- I. Analysis of research data using statistical software.
- II. Opting a career as analyst.
- III. Development of consultancy firms and project formulation.

PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Outcome:

- Identify library services and availability of resources in order to develop a realistic overall plan for research to achieve a manageable focus appropriate to the assignment criteria, available resources, and evidence needed to support thesis.
- Identify keywords, synonyms and related terms in order to flexibly search information resources including: Internet, electronic library catalogs, and print materials
- Identify the range of information source types available (such as peer-reviewed journals, newspaper articles, books, reference sources, etc.), their distinguishing characteristics and intended audiences, in order to select those appropriate based on the information need.
- Identify the features and content of different research tools (such as databases, catalogs and websites) in order to search those most appropriate to the information need.

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 1(0+1)

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc.

To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing). While the emphasis will be on writing, oral communication of scientific and technical information will form an important component of the course, as well.

Outcomes

By the end of this course students will be able to

- 1) Develop skills that will enable to produce clear and effective scientific and technical documents.
- 2) Use visual items in effectively constructing meaning in communication situations.
- 3) Create clear, concise technical documents that effectively use style and grammar and information structure in ways that create meaning with the reader.
- 4) Collaborate effectively in various writing situations, including planning, creating, and managing, evaluating, editing and revising document production

PGS 503 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE 1(1+0)

Objective:

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Outcome:

- 1) Exposure to various types intellectual property rights.
- 2) Idea on various acts and agreements related to IPR.
- 3) Knowledge on protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, and farmers rights.

PGS 504 BASIC CONCEPTS IN LABORATORY TECHNIQUES 0+1

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Outcome

- A brief knowledge on the safety protocols to be followed in a laboratory and handling of various equipments present in the laboratory.
- Knowledge on preparations of several standard solutions, agro-chemical doses, buffers, etc for laboratory and field purposes.
- Testing the seed viability, pollen viability and description of flowering plants.

PGS 505 (e-Course) AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES 1(1+0)

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Outcomes

- By the end of this course scholars will be sensitized about the basic issues related with agricultural research, ethics in research as well as rural development.
- The scholars will be also educated about principles and philosophy of rural development and various ongoing rural and community development programmes and policies.

- Students will also be motivated towards practising and promoting ethics in research and developmental endeavours.

PGS 506

DISASTER MANAGEMENT

1+0

Objectives

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

Outcome

- A brief knowledge on nature and effects of different natural disasters and their management
- Knowledge on different types of man-made disasters and their management
- Appraisal on different organizations involved in disaster management at national and global level

Name of the Course	Course Code	Mapping of COs to POs & PSOs									
		Course Outcomes	P O 1	P O 2	P O 3	P O 4	PS O 1	PS O 2	PS O 3	PS O 4	
Principles of Genetics	PBG 501	CO1	✓				✓				
		CO2	✓				✓				
		CO3	✓	✓			✓		✓		
		CO4	✓	✓			✓		✓		
Principles of Cytogenetics	PBG 502	CO1	✓				✓				
		CO2	✓				✓				
		CO3	✓				✓				

Principles of Plant Breeding	PBG 503	CO1	✓				✓			
		CO2	✓		✓		✓		✓	
		CO3	✓	✓	✓		✓		✓	✓
Principles of Quantitative Genetics	PBG 504	CO1	✓				✓			
		CO2		✓			✓		✓	
		CO3		✓			✓		✓	
Cell Biology & Molecular Genetics	PBG 505	CO1	✓				✓			
		CO2	✓				✓			
		CO3	✓				✓			
		CO4	✓				✓			
Heterosis Breeding	PBG 506	CO1	✓		✓	✓	✓		✓	✓
		CO2	✓	✓	✓		✓		✓	
		CO3	✓	✓	✓		✓		✓	
		CO4				✓				✓
Gene Regulation and Expression	PBG 507	CO1	✓				✓			
		CO2	✓				✓			
		CO3	✓				✓		✓	
Population Genetics	PBG 508	CO1	✓				✓			
		CO2	✓				✓			
		CO3	✓				✓			
Mutagenesis and Mutation Breeding	PBG 509	CO1	✓				✓			
		CO2		✓					✓	
		CO3		✓	✓				✓	

Germplasm Collection Exchange and Quarantine	PBG 510	CO1		✓	✓				✓	
		CO2		✓	✓				✓	
		CO3	✓						✓	
Biotechnology for Crop Improvement	PBG 511	CO1		✓		✓				✓
		CO2	✓	✓				✓	✓	
		CO3		✓				✓	✓	
		CO4	✓					✓	✓	
Breeding for Biotic and Abiotic Stress Resistance	PBG 512	CO1	✓				✓			
		CO2		✓			✓		✓	
		CO3		✓			✓		✓	
Breeding Cereals, Forages and Sugarcane	PBG 513	CO1	✓				✓			
		CO2		✓					✓	
		CO3		✓			✓		✓	
Breeding Legumes, Oilseeds & Fibre crops	PBG 514	CO1	✓				✓			
		CO2		✓					✓	
		CO3		✓			✓		✓	
Breeding for Quality traits	PBG 515	CO1	✓				✓			
		CO2		✓					✓	
		CO3		✓					✓	
Maintenance Breeding, Concepts of variety Release and Seed Production	PBG 516	CO1		✓					✓	
		CO2	✓	✓			✓		✓	
		CO3		✓		✓			✓	✓
		CO4		✓					✓	

Data base management, Evaluation and Utilization of PGR	PBG 517	CO1		✓					✓	
		CO2	✓	✓			✓		✓	
		CO3	✓	✓				✓	✓	
Master's Seminar	PBG 591	CO1		✓				✓	✓	
Master's Research	PBG 599	CO1		✓				✓	✓	
Physiological and molecular responses of plants to abiotic stresses	PP 503	CO1	✓				✓		✓	
		CO2	✓				✓			
		CO3		✓						✓
Experimental designs	STAT 510	CO1	✓	✓			✓		✓	
		CO2	✓				✓			
		CO3	✓				✓			
		CO4		✓						✓
Data analysis using statistical packages	STAT 513	CO1	✓				✓			
		CO2		✓					✓	
		CO3				✓				✓
Library and information Services	PGS 501	CO1	✓					✓		
		CO2		✓			✓			
		CO3			✓		✓			
		CO4	✓					✓		
Technical Writing and Communications skills	PGS 502	CO1		✓			✓	✓		
		CO2	✓				✓			
		CO3	✓		✓			✓		

Intellectual Property and its Management in agriculture	PGS 503	CO1	✓				✓		
		CO2	✓				✓		
		CO3		✓					✓
Basic concepts in Laboratory Techniques	PGS 504	CO1		✓					✓
		CO2			✓				✓
		CO3			✓		✓		✓
Agricultural Research, Research ethics and Rural Development programmes	PGS 505	CO1	✓				✓		✓
		CO2	✓	✓			✓		✓
		CO3		✓			✓		✓
Disaster management	PGS 506	CO1	✓			✓	✓		
		CO2	✓			✓	✓		
		CO3	✓				✓		

Mapping of COs vs. Employability/ Entrepreneurship/ Skill development				
Name of the Course	Course Code	Employability	Entrepreneurship	Skill development
Principles of Genetics	PBG 501			Y
Principles of Cytogenetics	PBG 502			Y
Principles of Plant Breeding	PBG 503	Y		Y
Principles of Quantitative Genetics	PBG 504			Y
Cell Biology & Molecular Genetics	PBG 505			Y
Heterosis Breeding	PBG 506	Y	Y	Y
Gene Regulation and Expression	PBG 507	Y		Y
Population Genetics	PBG 508			Y
Mutagenesis and Mutation Breeding	PBG 509	Y		Y
Germplasm Collection Exchange and Quarantine	PBG 510	Y		Y
Biotechnology for Crop Improvement	PBG 511	Y	Y	Y
Breeding for Biotic and Abiotic Stress Resistance	PBG 512	Y		Y

Breeding Cereals, Forages and Sugarcane	PBG 513	Y		Y
Breeding Legumes, Oilseeds & Fibre crops	PBG 514	Y		Y
Breeding for Quality traits	PBG 515	Y		Y
Maintenance Breeding, Concepts of variety Release and Seed Production	PBG 516	Y	Y	Y
Data base management, Evaluation and Utilization of PGR	PBG 517	Y		Y
Master's Seminar	PBG 591			Y
Master's Research	PBG 599			Y
Physiological and molecular responses of plants to abiotic stresses	PP 503	Y		Y
Experimental designs	STAT 510	Y		Y
Data analysis using statistical packages	STAT 513	Y	Y	Y
Library and information Services	PGS 501			Y
Technical Writing and Communications skills	PGS 502			Y
Intellectual Property and its Management in agriculture	PGS 503	Y		Y
Basic concepts in Laboratory Techniques	PGS 504	Y		Y
Agricultural Research, Research ethics and Rural Development programmes	PGS 505			Y
Disaster management	PGS 506	Y		Y