New & Restructuring of Post Graduate Curriculum & Syllabus for M.Sc. (Ag.)-G.P.B. w.e.f. Session: 2019-20 Semester System as per Fifth Deans Committee Reoprt of ICAR

Submitted & Approved By-
Board of Studies
Faculty of Agriculture
Dr.Ram Manohar Lohia Avadh University
Ayodhya (U.P.) 224001
### M.Sc. (Ag.) GENETICS AND PLANT BREEDING

#### Course Structure – at a Glance

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Credit hours</th>
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<tbody>
<tr>
<td><strong>Major courses</strong></td>
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</tr>
<tr>
<td>GP 501*</td>
<td>Principles of Genetics</td>
<td>3(2+1)</td>
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<tr>
<td>GP 502*</td>
<td>Principles of Cytogenetics</td>
<td>3(2+1)</td>
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<td>Master’s Seminar</td>
<td>1(0+1)</td>
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<tr>
<td>GP 599</td>
<td>Master’s Thesis OR Special Papers (any additional courses enlisted optional courses or following courses may be taken to fulfill the requirements)</td>
<td>20</td>
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<tr>
<td>GP 513</td>
<td>Breeding For Quality Traits</td>
<td>4(3+1)</td>
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<tr>
<td>GP 514</td>
<td>Seed production testing and certification</td>
<td>4(3+1)</td>
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<td>GP 517</td>
<td>Data Base Management, Evaluation And Utilization of PGR</td>
<td>4(3+1)</td>
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<td>Experimental Design In Plant Breeding</td>
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<td><strong>Supporting Courses</strong></td>
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<td>AS 501</td>
<td>Agricultural Statistics</td>
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<td>CA 502</td>
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<td>Principles of Cytogenetic</td>
<td>3(2+1)</td>
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**Total credit hours** 12(2+3)

### Second Semester

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**Total credit hours** 9(5+4)
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Total credit hours **55**
M.Sc.(Ag.) GENETICS AND PLANT BREEDING
COURSE CONTENT – DETAILED SYLLABUS

GPB 501: PRINCIPLES OF GENETICS

THEORY

UNIT I
Beginning of genetics: Cell structure and cell division; Mendel’s law; Discussion on Mendel’s paper; Chromosomal theory of inheritance

UNIT II
Multiple allele, Gene interaction, Sex determination, Sex linkage, Sex influenced and Sex limited traits, Linkage – detection, estimation, Recombination and genetic mapping in eukaryotes; Somatic cell genetics, Extra chromosomal inheritance.

UNIT III
Structural and numerical changes in chromosomes, Nature, Structure and replication of the genetic material; Organization of DNA in chromosomes, Genetic code.

UNIT IV
Classical and modern genenconcept; Genetic fine structure analysis, Allele complementation, Split genes, Transposable genetic elements, Overlapping genes, Pseudogene, Oncogenes, Gene families and clustures.

UNIT V
Molecular mechanisms of mutation, repair and suppression: Bacterial plasmid, Gene expression, Gene regulation in eukaryotes, RNA editing

UNIT VI
Gene isolation, synthesis and cloning, genomics and cDNA libraries, PCR based cloning, positional cloning: Nucleic acid Hybridization; DNA sequencing; DNA restriction and modification, Antisense RNA and ribozymes: Micro – RNAs (miRNAs).

UNIT VII
Concept of Eugenics, Epigenetic, Genetic disorder and Behavioral genetics.
PRACTICAL

GP502: PRINCIPLES OF CYTOGENETICS
THEORY
UNIT I

UNIT II
Cell cycle and Cell Division: mitosis and meiosis: Differences, significance and deviation—Synapsis, structure and function of synaptonemal complex and spindle apparatus, anaphase movement of chromosomes and crossing over—mechanism and theories of crossing over-recombination models. Cytological basis of Variation for karyotyping: Chromosome banding and Painting—in situ hybridisation and various applications.

UNIT III
Structural and numerical variations of chromosomes and their implication symbols and terminologies for chromosome numbers—euploidy—haploids and
polyploids: utilization of aneuploids in gene location, evolutionary significance of chromosomal aberrations, balanced, lethal and chromosome complexes.

UNIT IV
Inter-varietal chromosome substitutions, Polyploidy and role of polyploidy in crop breeding: Evolutionary advantages of autoploidy vs allopolyploidy - Role of aneuploids in basis and applied aspects of crop breeding, their maintenance and utilization in gene mapping and gene blocks transfer - Alien addition and substitution lines - creation and utililization, Apomixis - Evolutionary and genetic problems in crops with apomixis.

UNIT V
Reversion of autoploids to diploids: Genome mapping in polyploids - Interspecific hybridization and allopolyploids: Synthesis of new crops (wheat, triticale and brassica) - Hybrids between species with same chromosomenumber: Genetransfer using amphidiploids - Bridge species.

UNIT VI
Fertilization barriers in crop plants at pre and post fertilization levels - in vitro techniques to overcome the fertilization barriers in crops: Chromosome manipulations in widehybridization, case studies - production and use of haploids, dihaploids double haploids in genetics and breeding.

Practical
Learning the cytogenetic's: various chemicals to be used for fixation, dehydration, embedding, staining, cleaning etc.
Microscopy: various types of microscopes: Observing section of specimen using microscope: Preparing specimen for observation - Fixative preparations and fixing specimen for light microscopy studies in cereals. Studies on the courses of mitosis in wheat, pearl millet: Studies on the courses of mitosis in onion: Studies on the course of meiosis in cereals, millets, pulses and in oilseeds: Using micrometers and studying the pollen grain size in various crops - Various methods of staining and preparation and temporary and permanent slides - Pollens germination
in vivo and invitro. Microtomy and steps in microtomy: Agents employed for the
induction of various ploidy levels: Solution preparation and application at seed,
seedling level-Identification of polyploids in different crops-Induction and
identification of haploids: Morphological observations on synthesizes
autopolyploids, Morphological observation on allopolyploids: Morphological
observation on aneuploids: Cytogenetics analysis of interspeccific and intergeneric
crosses: Maintenance of Cytogenetic stocks and their importance in crop
breeding.

GPB 503: PRINCIPLES OF PLANT BREEDING

THEORY

UNIT I

History of plant breeding: Objectives of plant breeding, characteristics improved
by plant breeding, patterns of evolution in crop plants: Centres of origin –
biodiversity and its significance.

UNIT II

Genetics basis of breeding: self and cross -pollinated cross including mating
system and response to selection - nature of vriability, components of variation
Heritability and genetic advance, genotype environment interaction: Types of
gene action and implication and plant breeding: plant introduction and role of plant
genetic resources in plant breeding.

UNIT III

Self -incompatibility and male sterility in crop plants and their commercial
exploitation: Concept plant ideotyper and its role in crop improvement,
Transgressive breeding.

UNIT IV

Pure line theory, pure line selection and mass selection methods, Line breeding,
pedigree bulk, back cross, single seed descent and multiline method. Population
breeding in self-pollinated crops (di allele selective mating approach)

UNIT V
Breeding methods in asexually /clonally propagated crops, clonal selection, apomixis.

UNIT VI
Breeding for Biotic and Abiotic stresses.

UNIT VII
Cultivar development—Testing release and notification, maintenance breeding. Participatory Plant Breeding, Plant breeders right and regulations for plant variety protection and farmers rights.

Practical

GPB 504: PRINCIPLES OF QUANTITATIVE GENETICS

THEORY

UNIT I
Mendelian traits vs polygenic traits—nature of quantitative traits and its inheritance—Multiple factor hypothesis—analysis of continuous variation: Variation associated with polygenic traits—phenotypic, genotypic and environmental—non allelic interaction: Nature of gene action—additive, dominance, epistasis and linkage effect.

UNIT II
Principles of analysis of variance (ANOVA)—Expected variance components, random and fixed models: MANOVA, biplot analysis: Comparison of means and variances for significance

UNIT III

UNIT IV
Generation mean analysis: Mating design—Diallel, partial diallel, line x tester, NCDs and TTC: Concept of combining ability and gene action: Analysis of genotype x environment interaction—adaptability and stability: Models for GXE analysis and stability parameters.

Practical
GPB-508: CELL BIOLOGY AND MOLECULAR BIOLOGY

THEORY

UNIT I
Ultra structure of the cell: differences between eukaryotic and prokaryotic cells, macromolecules, structure and function of cell wall, nuclear membrane and plasma membrane: Cellular Organelle - nucleus, plastid, chloroplast/chromoplast, mitochondria, endoplasmic reticulum, Golgi complex.

UNIT II
Bioenergetics: Ultrastructure and function of mitochondria, chloroplast, and other photosynthetic organelles: Interpretation of nucleus - Structure and chemical composition: Cell division and physiology of cell division.

UNIT III
Historical background of molecular genetics: Genetic material in organism: Structure and properties of nucleic acid.

UNIT IV
DNA content variation, types of DNA sequences - Unique and repetitive sequences: Organelle genomes: Gene amplification and its significance.

PRACTICAL

UNIT 509: BIOTECHNOLOGY FOR CROP IMPROVEMENT

THEORY

UNIT I

Biotechnology and itsd relevance in agriculture: Definition, Terminologies and scope in plant breeding.

UNIT II

Tissue culture: History, callus, suspension culture, cloning, Regeneration, Somatic embryogenesis: Anther culture, somatic hybridization techniques, Meristem, ovary and embryo culture; cryopreservation.

UNIT III

Techniques of DNA isolation, Quantification and analysis, Genotyping, Sequencing techniques: vectors, vector preparation and cloning, Molecular markers: morphological, biochemical and DNA based markers (RFLP, AFLP, SSR, SNPs and ESTs), mapping populations.

UNIT IV

Molecular mapping and tagging of agronomically important traits, statistical topols in marker analysis, Gene pyramiding.

UNIT V

Marker assisted selection and molecular breeding: Genomics for crop improvement: Integrating functional genomics information on agronomically / economically important traits in plant breeding.

UNIT VI

Recombinant DNA technology, transgenes, method of transformation: vector mediated gene transfer, physical methods of gene transfer. Production of transgenic plants in various field crops, cotton, wheat maize, rice, soybean, sugarcane, commercial release.

UNIT VII

Biotechnology applications in male sterility/hybrid breeding, molecular farming.
UNIT VIII
GMO, International regulations, biosafety issues of GMOs: Regulatory procedures in major countries including India, ethical, legal and social issues, Intellectual property rights.

UNIT IX
Nanotechnology and its applications in crop improvement programmes.

PRACTICAL
Requirement for plant tissue culture laboratory—Techniques in plant tissue culture
Media components and media preparation—Aseptic manipulation of various explants, observation on the containments occurring in media—interpretation—
Inoculation of explants: callus induction and plant regeneration. Plant regeneration:
standardizing the protocols for regeneration:
Hardening of regenerated plants:
Establishing a greenhouse and hardening procedures—visit to commercial micro
propagation unit, construction of genetic linkage maps using computer software.

GPB-510: BREEDING FOR BIOTIC AND ABIOTIC STRESS RESISTANCE
THEORY
UNIT I
Importance of plant breeding with special reference to biotic and abiotic stress resistance:
Classification of biotic stresses—major pests and diseases of economically important crops.
Concepts in insect and pathogen resistance:
Analysis and inheritance of resistance variation.
Host defense responses to pathogen invasion—Biochemical and molecular mechanism:
Acquired and induced immunity and systemic acquired resistance (SAR): Host—pathogen interaction,
gene for gene hypothesis.

UNIT II
UNIT III
Phenotypic screening methods for major pests and diseases: Recording of observation: Correlating the observations using marker data-Gene pyramiding methods and their implications.

UNIT IV

UNIT V
Genetics of abiotic stress resistance, Genes and genomics in breeding cultivars suitable to low water regimes and water logging & submergence, high and low/freezing temperatures: Breeding for resistance to stresses caused by toxicity, deficiency and pollutants/contaminants in soil, water and environment.

UNIT VI
Exploitation of wild relatives as a source of resistance to biotic and abiotic factors in major field crops: Bt for diseases and insect pest management—Achievements.

PRACTICAL
Phenotypic screening techniques for sucking pests and chewing pests—Traits to be observed at a plant and insect level—Phenotypic screening techniques for nematodes and borer: Ways of combating them; Breeding for herbicide resistance—Evaluating the available population like RIL, NIL, etc for pest resistance; Phenotypic screening methods for disease caused by fungi and bacteria: Quality parameters evaluation: Screening crops for drought and flood resistance; Screening varieties of major crops for acidity and alkalinity—Their effects and breeding strategies.
GPB 515: MAINTENANCE BREEDING AND CONCEPTS OF VARIETY RELEASE AND SEED PRODUCTION

THEORY

UNIT I
Variety Development and maintenance: Definition variety, cultivar, explants variety, essentially derived variety, independently derived variety, reference variety, farmers variety hybrid and population, variety testing, release and notification systems in India and abroad.

UNIT II
DUS testing—DUS descriptors of varieties—safeguards during seed production: Maintenance of varieties in self and cross-pollination crops—isolation distance: Principles of seed production: Methods of nucleus and breeder seed production.

UNIT III
Generation systems of seed multiplication—nucleus, breeders, foundation, certified—Quality seed production technology of self and cross-pollination crops—isolation distance: Principles of seed production: Methods of nucleus and breeder seed production.

UNIT IV
Generation system of seed multiplication—nucleus, breeders, foundation, certified—Quality seed production technology of self and cross-pollinated crop varieties viz cereals & millets (wheat, paddy pearl millet, sorghum, maize) Pulses (Pigeonpea, chickpea, Field pea); Oilseeds (groundnut, sunflower, rapeseed and mustard); fibre (cotton). Seed certification procedure: Seed laws and plant variety protection regulations a in India and international systems.

PRACTICAL
Identification of suitable area/locations for seed production Ear to row method and nucleus seed production—Main characteristics of released and notified varieties, hybrids and parental lines: Identification of important weeds/objectionable weeds: Determination of isolation distance and planting ratios in
different crops: Seed production techniques of varieties in different crops, Hybrid seed production technology of important crops.

**COMPULSARY NONCREDIT COURSES**
(Compulsory for master's programme in all disciplines: Optional for PhD scholars)

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**Course content**

**PGS501: 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 engine etc.) of information search.

**Practical**

Introduction to library and its services: Role of libraries in education, research and technology transfer, classification systems and organization of library: Sources of information – Primary sources, Secondary sources and tertiary sources: Intricacies of abstracting and indexing services (Science Citation Index, Biological abstracts, Chemical abstract, CABI abstract etc.) Tracing information from reference source: Literature survey: Chemical abstracts CABI Abstract etc) Tracing information from reference sources: Literature survey
Citation techniques / Preparation of bibliography, Use of CD-ROM database, Outline public access catalogue and other computerizes library services: Use of internet including search engines and its resources, e-resources access methods.

PGS 502: TECHNICAL WRITING AND COMMUNICATION SKILLS

Objective

To equip the students/scholars with skills to write dissertations, research paper etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical:

Technical writing: Various forms of scientific writings—these technical papers, reviews, manuals, etc., various parts of thesis and research communications (title page, authorship, content page, preface, introduction, review of literature, material and method, experimental results and discussion): Writing of abstracts, summaries, precise, citation, etc., commonly used abbreviations in the theses and research communications; illustration, photographs and drawing with suitable captions, pagination, numbering of tables and illustration. Writing of numbers and dates in scientific write-ups, Editing and proofreading: Writing of a review of article.

Communication skills: Grammar (Tense, parts of speech, clauses, population marks), Error analysis (Common errors), Concord, Collection: Phonetic symbols and transcription: Accentual pattern, weak forms in connected speech, Participation in group discussion, Facing an interview, presentation of scientific papers.

[Signatures]
PGS 503 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE

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.

Theory

Historical perspectives and need for the introduction of intellectual property right regime: TRIPs and various provision in TRIPS Agreement, Intellectual property right benefits of securing IPRs: Indian legislations for the protection of various types of intellectual secret and traditional knowledge, trademarks, protection of plant varieties and farmers right and biodiversity, protection: Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection: National biodiversity protection initiatives: Convention on biological diversity: International Treaty on plant genetic resources for food and agriculture, licensing of technologies, Material transfer agreements, research collaboration agreement, licence agreement.

PGS 504 BASIC CONCEPTS IN LABORATORY TECHNIQUES

Objectives

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

Practical

Safety measures while in lab: Handling of chemical substances: Use of burette, pipette, measuring cylinder, flasks, separately funnel, condensers, micropipette and vacuum pumps: washing, drying and
sterilization of glassware: drying of solvents /chemicals, weighing and preparation of solutions of different strength and their dilution: Handling techniques of solutions: Preparation of different agro-chemical doses in field and pot application, preparation of solutions of acids: Neutralisation of acid and bases: preparation of buffers of different strengths and pH


PGS 505 AGRICULTURAL RESEARCH RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES

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.

Theory

UNIT I

History of agriculture in brief: Global agricultural research systems: need scope, opportunities: Role in promoting food security, reducing poverty and protecting the environment. National Agricultural Research Systems (NARS) and Regional Agricultural research institution: Consultative group on international agricultural research (CGIAR): International Agricultural research centres (IARC), Partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels, international fellowship 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.

Concept and connations 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 organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

PGS 506 DISASTER MANAGEMENT

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.

UNIT I

Natural disasters – Meaning and nature of natural disasters, their types and effects. Flood, drought, cyclone, earthquake, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change, global warming, Sea level rise, ozone depletion.

UNIT III

Man made disasters – nuclear disasters, chemical disaster, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, Industrial waste, water 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 organization, and media, central state, district, and local administration, armed forces in disaster response, disaster response, police, and other organizations.

Common course for M.Sc. (Ag) all subjects

CA 502 COMPUTER APPLICATION IN AGRICULTURE

THEORY

Introduction to computers, Operating systems, definition and types, application of MS-Office for document creation & editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concept and types, use of DBMS in Agriculture, world wide web (www): Concept and components. Introduction to computer programming language s, concept and standard input/output operations.

Agriculture, concepts and applications, Use of ICT in agriculture, Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for agriculture management, smart phone apps in agriculture, farm devices market price, post harvest management etc. Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components, and applications in agriculture, agriculture expert system, soil information systems, etc., for supporting farm decision, preparation of contingent crop-planning using IT tools.

PRACTICAL
Study of computer components, accessories, practice of important DOS Commands, introduction of different operating systems such as window, unix/Linux, Creating, Files & folder, File management, Use of MS –World and MS PowerPoint for creating editing and presenting a scientific documents MS-ACCESS.Creating database, preparing queries and reports, demonstration of agriinformation system. Introduction to world wide web (www) .Introduction of programming language .Hands on crop simulation models (CSM) such as DSSAT/Crop –Info/Crop Syst/ Wofost:Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial technology for generating valuable information for agriculture .Hands on decision support system, preparation of contingent crop planning.

Common course for M.Sc. (Ag) all subjects

AS501 AGRICULTURE STATISTIC
UNIT I
Classification tabulation and graphical representation of data, Box-plot descriptive statistics. Exploratory data analysis: Theory of probability, Random variable and mathematics expectation.

UNIT II
Discrete and continuous probability distribution: Biomial, Poisson, Normal distribution, Concept of sampling distribution: Chi-square, t and f distribution, Test of significance based on normal, chi-square, t and f distribution, Large sample theory.

UNIT III
Introduction to theory of estimation and confidence intervals, Correlation and regression, simple and multiple linear regression model, estimation of parameters, predicted values and residuals, correlation coefficient, partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient, test of significance of correlation coefficient and regression coefficients, coefficient of determination.
UNIT IV
Need for designing of experiments, characteristics of a good design, Basic principles of design, randomization, replications and local control.

UNIT V
Uniformity traits, size and shape of plots, analysis of variance, completely randomized design, randomized block design and Latin square design, missing plot techniques split plot design.

UNIT VI
Sampling techniques—planning of survey, method of data collection, questionnaire vs schedule, Problems of sampling frame, choice of sample of design, probability sampling, sample space, sampling design, simple design simple random sampling, estimation of proportion, confidence interval, determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation, Non sampling error—source and classification.

PRACTICAL
On the topic listed on the theory syllabus.

GP,513 : BREEDING FOR QUALITY TRAITS THEORY
UNIT I
Genetics of carbohydrates, proteins, fats, vitamins, and anti-nutritional factors; Breeding for grain quality parameters in rice and its analysis, Golden rice and aromatic rice; Breeding strategies, achievements and application in Indian context.

UNIT II
Breeding for baking qualities in wheat; Characters to be considered and breeding strategies; Molecular and cytogenetic manipulation for quality improvement in wheat.
UNIT III
Breeding for quality improvement in Sorghum and pearl millet; Quality protein maize. Concept and breeding strategies; Genetic resource management for sustaining nutritive quality in crops.

UNIT IV
Breeding for quality in chickpea and pigeon pea; Breeding for quality in rapeseed and mustard, groundnut, and sunflower and minor oilseeds; Genetic manipulation for quality improvement in cotton.

Practical
Grain quality evaluation in rice, Correlating ageing and quality improvement in rice, Quality analysis in millets; Estimation of an nutritional factors like tannins in different varieties/hybrids; Quality parameters evaluation in wheat, Quality parameters evaluation in pulses and Quality parameters evaluation in oilseeds; Value addition in crop plants; Post harvest processing of major field crops.

GP 514 : Seed production testing and certification

UNIT I
History and importance of seed technology, classes of seeds, characteristics of quality seeds, general techniques of seed production in important agricultural and vegetable crops:

Cereals : wheat, rice, barley
Millets: Maize, sorghum, bajra
Pulses : Chickpea, pigeonpea, fieldpea, urd, bean, moongbean and lentil
Oilseeds : Rapeseed, mustard, groundnut, sunflower
Vegetable crops : Cole crops, root crops, solenaceous and cucurbitaceous crops

UNIT II
Seed testing and its important, seed testing procedure (Purity analysis, moisture testing, germination, viability and vigour testing)
UNIT III
History of seed certification, seed acts and seed rules, seed certification purpose, organization and functions, standard for different classes of seeds. Isolation, post harvest inspection and procedure, sampling role of central and state seed testing labs in seed quality control.

Practical
Seed testing procedure (Purity analysis, moisture testing, germination, viability and vigour testing) and seed health testing, post harvest inspection and procedure sampling seed quality control.

GP 517: DATA BASE MANAGEMENT, EVALUATION AND UTILIZATION OF PGR THERORY
UNIT I
Statistical Techniques in management of germplasm; Core identification, estimation of sample size during plant explorations, impact of sampling on population structure, sequential sampling for viability estimation, Estimation of sample size for storage and viability estimation, Estimation of sample size for storage and viability testing.

UNIT II
Germplasm documentation; Basics of computer and operating systems; Database management system, use of statistical software’s, pictorial and graphical representation of data.

UNIT III
Germplasm management system- global scenario; Genetic variation in crop plants and management of germplasm collections, limitations in use of germplasm collections; necessity of germplasm evaluation; Predictive methods for identification of useful germplasm; Characterization of germplasm and evaluation
procedures including specific traits; Gene markers and their use in PGR management.

UNIT IV
Management and utilization of germplasm collections; Concept of core collection, molecular markers and their use in characterization; Evaluation and utilization of genetic resources; Pre-breeding/genetic enhancement, utilizing wild species for crop improvement.

Practical
Basics of computer and operating systems, Identification of useful germplasm, evaluation of crop germplasm; Statistical techniques in management of germplasm estimation of sample size for storage and viability testing; Evaluation procedure and experimental protocols (designs and their analysis), Assessment of genetic diversity; Techniques of Characterization of germplasm; Molecular markers and their use in characterization.

GP 595 : EXPERIMENTAL DESIGNS PLANT BREEDING 4 (3+1)

UNIT I

UNIT II
Statistical analysis and advantage and disadvantage of basic design—Completely Randomized Design, Randomized Block Design, Latin Square Design.

UNIT III
Split plot design.

UNIT IV
Missing plot technique: Bartlett’s techniques for missing plots, cross-over design or switch-over trials, Rotational experiments, progeny selection, compact family block design, uniformity trial, sampling in field experiments.
Practical
Analysis of data generated from completely randomized design, randomized block design; Latin square design, Split plot designs, Missing plot techniques, Analysis of covariance, Sampling in field experiments.

GP 596 : INNOVATIVE APPROACHES IN PLANT BREEDING 4 (4+0)
THEORY
UNIT I
Introduction, Markers; morphological, isozymes, DNA markers (RFLP, RAPD, AFLP, SSR, SNP). Construction of linkage map; use of mapping populations (F2.RILS, NILs, back cross, doubled haploids)- applications advantage’s, constraints. Applications of molecular markers; finger printing phylogenetic relationships Tagging agronomically important traits. Assessing heterotic performance; Marker assisted selection (MAS) for oligogenic traits, MAS for QTLs, Gene pyramiding using molecular markers.

UNIT II
Transgenic plants, applications of transgenic technology, molecular farming, antisense RNA technology, stability of transgenes, integration of transgenics in plant breeding.

UNIT III
Biosafety issues of transgenics. Somatic hybridization applications and constraints. Somaclonal variation in crop improvement; overview and future prospects.

UNIT IV

UNIT V
Functional markers, Reverse genetics approaches. Targeting Induced Local Lesions IN Genomes (TILLING). ECOTILLING and its application in crop breeding.