M.Sc. (Agri.) Genetics & Plant Breeding
Teaching Scheme & Curriculum
Semester 1

Subjects				Contact Hours/Week			Theory Marks		Practical/Viva Marks		Total Marks
Sr.	Name	Type	Credit	Lect	Tut	Lab	T	T	P	P	
1	Principles of Genetics	Major	3	2	-	2	50	50	-	-	100
2	Principles of Plant Breeding	Major	3	2	-	2	50	50	-	-	100
3	Fundamentals of Quantitative Genetics	Major	3	2	-	2	50	50	-	-	100
4	Varietal Development and Maintenance Breeding	Major	2	1	-	2	50	50	-	-	100
5	Principles of Biotechnology	Minor	3	3	-	0	50	50	-	-	100
6	Experimental Designs	Supporting	3	2	-	2	50	50	-	-	100
7	Library and Library Information Services	Non-Gradial	1	0	-	2			-	100	100
8	Basic Concepts in Laboratory Techniques	Non-Gradial	1	0	-	2			-	100	100
		Total	**19**	**12**	**-**	**14**					**800**

Lect *- Lecture,* ***Tut*** *- Tutorial,* ***Lab*** *- Lab,* ***T*** *- Theory,* ***P*** *- Practical*

Theory Passing % : *60* ***Practical Passing % :*** *60*

Prerequisite	Basic knowledge of biology, botany, and introductory genetics at UG level.
Rationale	Genetics forms the foundation for understanding heredity, variation, and crop improvement. The course provides conceptual and practical understanding of gene action and inheritance patterns.
Course Title	**Principles of Genetics***
Credits	3(2+1)
Objectives of the course	1. To understand principles of inheritance and genetic laws. 2. To study chromosome behavior and gene interaction. 3. To explain linkage, crossing over, and mutation. 4. To develop knowledge of genetic applications in crop improvement
Syllabus	
Theory	Unit I Beginning of genetics, early concepts of inheritance, Mendel's laws; Discussion on Mendel's paper, Chromosomal theory of inheritance; Multiple alleles, Gene interactions, Sex determination, differentiation and sex-linkage, Sex-influenced and sex-limited traits; Linkage-detection, estimation; Recombination and genetic mapping in eukaryotes, Somatic cell genetics, Extra chromosomal inheritance. Unit II Mendelian population, Random mating population, Frequencies of genes and genotypes, Causes of change: Hardy-Weinberg equilibrium. Unit III Nature, structure and replication of the genetic material; Organization of DNA in chromosomes, Genetic code; Protein biosynthesis, Genetic fine structure analysis, Allelic complementation, Split genes, overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters; Regulation of gene activity in prokaryotes and eukaryotes; Molecular mechanisms of mutation, repair and suppression; Bacterial plasmids, insertion (IS) and transposable (Tn) elements; Molecular chaperones and gene expression, RNA editing. Unit IV Gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR based cloning, positional cloning; Nucleic acid hybridization and immunochemical detection; DNA sequencing; DNA restriction and modification, Anti-sense RNA and ribozymes; Micro-RNAs (miRNAs). Unit V Genomics and proteomics; metagenomics; Transgenic bacteria and bioethics; Gene silencing; genetics of mitochondria and chloroplasts. Concepts of Eugenics, Epigenetics, Genetic disorders.
Practical	➢ Laboratory exercises in probability and chi-square; ➢ Demonstration of genetic principles using laboratory organisms; ➢ Chromosome mapping using three-point test cross; ➢ Tetrad analysis; Induction and detection of mutations through genetic tests; ➢ DNA extraction and PCR amplification; ➢ Electrophoresis: basic principles and running of amplified DNA; ➢ Extraction of proteins and isozymes; ➢ Use of Agrobacterium mediated method and Biolistic gun;

	➢ Detection of transgenes in the exposed plant material; ➢ Visit to transgenic glasshouse and learning the practical considerations
Course Outcomes	**CO1:** Explain the fundamental principles of inheritance, Mendelian laws, and gene interactions for solving basic genetic problems. **CO2:** Analyze chromosomal behavior, linkage, crossing over, and mutation mechanisms in different organisms using genetic data. **CO3:** Apply principles of population genetics and quantitative inheritance in crop improvement programs. **CO4:** Evaluate the role of modern genetics in agriculture, biotechnology, and plant breeding applications
Suggested Readings	Gardner EJ and Snustad DP. 1991. Principles of Genetics. John Wiley and Sons. 8th ed. 2006 Klug WS and Cummings MR. 2003. Concepts of Genetics. Peterson Edu. Pearson Education India; Tenth edition Lewin B. 2008. Genes XII. Jones and Bartlett Publ. (International Edition) Paperback, 2018 Russell PJ. 1998. Genetics. The Benzamin/ Cummings Publ. Co Singh BD. 2009. Genetics. Kalyani Publishers (2nd Revised Edition) Snustad DP and Simmons MJ. 2006. Genetics. 4th Ed. John Wiley and Sons. 6th Edition International Student Version edition Stansfield WD.1991. Genetics.Schaum Outline Series Mc Graw Hill Strickberger MW. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India; 3rd ed., 2015 Tamarin RH. 1999. Principles of Genetics. Wm. C. Brown Publs., McGraw Hill Education; 7 edition Uppal S, Yadav R, Singh S and Saharan RP. 2005. Practical Manual on Basic and Applied Genetics. Dept. of Genetics, CCS HAU Hisar.

Prerequisite	Knowledge of genetics and crop science.
Rationale	Plant breeding is essential for developing improved crop varieties with higher yield, quality, and stress resistance.
Course Title	**Principles of Plant Breeding***
Credits	3 (2+1)
Objectives of the course	1. To understand objectives and methods of plant breeding. 2. To study breeding systems in self- and cross-pollinated crops. 3. To learn selection and hybridization techniques. 4. To develop skills for crop improvement programs.
Syllabus	
Theory	**Unit I** Early Plant Breeding; Accomplishments through plant breeding; Objectives of plant breeding; Patterns of Evolution in Crop Plants: Centre of Origin, Agro-biodiversity and its significance. Pre-breeding and plant introduction and role of plant genetic resources in plant breeding. **Unit II** Genetic basis of breeding: self and cross pollinated crops including mating systems and response to selection; Nature of variability, components of variation; Heritability and genetic advance, genotype environment interaction; General and specific combining ability; Types of gene actions and implications in plant breeding. **Unit III** Pure line theory, pure line and mass selection methods; pedigree, bulk, backcross, single seed descent and multiline breeding; Population breeding in self-pollinated crops with special reference to diallel selective mating; Transgressive breeding. **Unit IV** Breeding methods in cross pollinated crops; Population breeding: mass selection and ear-to-row methods; S1 and S2 progeny testing, progeny selection schemes, recurrent selection schemes for intra and inter-population improvement and development of synthetics and composites. Hybrid breeding: genetical and physiological basis of heterosis and inbreeding, production of inbreeds, breeding approaches for improvement of inbreeds, predicting hybrid performance; seed production of hybrid and their parent varieties/ inbreeds. Self-incompatibility, male sterility and apomixes in crop plants and their commercial exploitation. **Unit V** Breeding methods in asexually/ clonally propagated crops, clonal selection. **Unit VI** Special breeding techniques: Mutation breeding, Breeding for abiotic and biotic stresses; Concept of plant ideotype and its role in crop improvement, concept of MAS, concept of polyploidy and wide hybridization, doubled haploidy. **Unit VII** Cultivar development: testing, release and notification, maintenance breeding, Participatory Plant Breeding, Plant breeders' rights and regulations for plant variety protection and farmers rights.
Practical	➢ Floral biology in self and cross pollinated species; ➢ Selfing and crossing techniques; ➢ Selection methods in segregating populations and evaluation of

	breeding material; ➢ Analysis of variance (ANOVA); ➢ Estimation of heritability and genetic advance; ➢ Maintenance of experimental records; ➢ Learning techniques in hybrid seed production using male-sterility in field crops; ➢ Prediction of performance of double cross hybrid.
Course Outcomes	**CO1:** Describe the objectives, scope, and significance of plant breeding in crop improvement programs. **CO2:** Apply selection, hybridization, and breeding methods for self- and cross-pollinated crops under field conditions. **CO3:** Analyze breeding strategies for developing high-yielding and stress-tolerant crop varieties. **CO4:** Evaluate suitable breeding approaches for specific crop improvement objectives and environmental conditions.
Suggested Readings	Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons. Chahal GS and Gossal, SS. 2002. Principles and Procedures of Plant Breeding Biotechnological and Conventional approaches. Narosa Publishing House. Chopra VL. 2004. Plant Breeding. Oxford & IBH. George A. 2012. Principles of Plant Genetics and Breeding. John Wiley & Sons. Gupta SK. 2005. Practical Plant Breeding. Agribios. Jain HK and Kharakwal MC. 2004. Plant Breeding and–Mendelian to Molecular Approach, Narosa Publications, New Delhi Roy D. 2003. Plant Breeding, Analysis and Exploitation of Variation. Narosa Publ. House. Sharma JR. 2001. Principles and Practice of Plant Breeding. Tata McGraw-Hill. Sharma JP. 2010. Principles of Vegetable Breeding. Kalyani Publ, New Delhi. Simmonds NW.1990. Principles of Crop Improvement. English Language Book Societ

Prerequisite	Principles of Genetics and basic statistics.
Rationale	Quantitative genetics helps in understanding inheritance of polygenic traits important in crop improvement.
Course Title	**Fundamentals of Quantitative Genetics***
Credits	3 (2+1)
Objectives of the course	1. To understand quantitative inheritance. 2. To study genetic variance and heritability. 3. To estimate genetic parameters in breeding populations. 4. To apply quantitative genetics in selection programs.
Syllabus	
Theory	**Unit I** Introduction and historical background of quantitative genetics, Multiple factor hypothesis, Qualitative and quantitative characters, Analysis of continuous variation mean, range, SD, CV; Components of variation- Phenotypic, Genotypic, Nature of gene action- additive, dominance and epistatic, linkage effect. Principles of analysis of variance and linear model, Expected variance components, Random and fixed effect model, Comparison of means and variances for significance. **Unit II** Designs for plant breeding experiments- principles and applications; Variability parameters, concept of selection, simultaneous selection modes and selection of parents, MANOVA. **Unit III** Association analysis- Genotypic and phenotypic correlation, Path analysis Discriminate function and principal component analysis, Genetic divergence analysis Metroglyph and D2, Generation mean analysis, Parent progeny regression analysis **Unit IV** Mating designs- classification, Diallel, partial diallel, L × T, NCDs, and TTC; Concept of combining ability and gene action, G × E interaction-Adaptability and stability; Methods and models for stability analysis; Basic models- principles and interpretation, Bi-plot analysis. **Unit V** QTL mapping, Strategies for QTL mapping- Desired population and statistical methods, QTL mapping in genetic analysis; Markers, Marker assisted selection and factors influencing the MAS, Simultaneous selection based on marker and phenotype.
Practical	➢ Analysis and interpretation of variability parameters; ➢ Analysis and interpretation of Index score and Metroglyph; ➢ Clustering and interpretation of D2 analysis; ➢ Genotypic and phenotypic correlation analysis and interpretation; ➢ Path coefficient analysis and interpretation, Estimation of different types of heterosis, inbreeding depression and interpretation; ➢ A, B and C Scaling test; ➢ L × T analysis and interpretation, QTL analysis; ➢ Use of computer packages; ➢ Diallel analysis; ➢ • G × E interaction and stability analysis.
Course	**CO1:** Explain quantitative inheritance and genetic variability in crop

Outcomes	populations using genetic principles. **CO2:** Calculate heritability, genetic advance, and variance components using quantitative genetic data. **CO3:** Analyze genetic parameters and selection responses in breeding populations. **CO4:** Evaluate the effectiveness of selection methods for quantitative trait improvement in crop breeding programs.
Suggested Readings	Falconer DS and Mackay J. 1998. Introduction to Quantitative Genetics (3rd Ed.).ELBS/ Longman, London. Mather K and Jinks JL.1985. Biometrical Genetics (3rd Ed.). Chapman and Hall, London. Nandarajan N and Gunasekaran M. 2008. Quantitative Genetics and Biometrical Techniques in Plant Breeding. Kalyani Publishers, New Delhi. Naryanan SS and Singh P. 2007. Biometrical Techniques in Plant Breeding. Kalyani Publishers, New Delhi. Roy D. 2000. Plant Breeding: Analysis and Exploitation of Variation. Narosa Publishing House, New Delhi. Sharma JR. 2006. Statistical and Biometrical Techniques in Plant Breeding. New Age International Pvt. Ltd. Singh P and Narayanan SS. 1993. Biometrical Techniques in Plant Breeding. Kalyani Publishers, New Delhi. Singh RK and Chaudhary BD. 1987. Biometrical Methods in Quantitative Genetic analysis. Kalyani Publishers, New Delhi. Weir DS. 1990. Genetic Data Analysis. Methods for Discrete Population Genetic Data. Sinauer Associates. Wricke G and Weber WE. 1986. Quantitative Genetics and Selection in Plant Breeding. Walter de Gruyter

Prerequisite	Plant breeding and seed science fundamentals.
Rationale	Maintenance breeding ensures genetic purity and stability of released varieties
Course Title	**Varietal Development and Maintenance Breeding**
Credits	2 (1+1)
Objectives of the course	1. To understand variety release procedures. 2. To study maintenance breeding methods. 3. To learn seed chain and nucleus seed production. 4. To ensure varietal purity and identity.
Syllabus	
Theory	**Unit I** Variety Development systemsand Maintenance; Definition- variety, cultivar, extant variety, essentially derived variety, independently derived variety, reference variety, farmers' variety, landraces, hybrid, and population; Variety testing, release and notification systems and norms in India and abroad. **Unit II** DUS testing- DUS Descriptors for major crops; Genetic purity concept and maintenance breeding. Factors responsible for genetic deterioration of varieties safeguards during seed production. **Unit III** Maintenance of varieties in self and cross pollinated crops, isolation distance; Principles of seed production; Methods of nucleus and breeder seed production; Generation system of seed multiplication -nucleus, breeders, foundation, certified. **Unit IV** Quality seed production technology of self and cross-pollinated crop varieties, viz., cereals and millets (wheat, barley, paddy, pearlmillet, sorghum, maize and ragi, etc.); Pulses (greengram, blackgram, cowpea, pigeonpea, chickpea, fieldpea, lentil); Oilseeds (groundnut, soybean, sesame, castor, sunflower, safflower, linseed, rapeseed and mustard); fibres (cotton/ jute) and forages (guar, forage sorghum, teosinte, oats, berseem, lucerne). **Unit V** Seed certification procedures; Seed laws and acts, plant variety protection regulations in India and international systems.
Practical	➢ Identification of suitable areas/ locations for seed production; ➢ Ear-to-row method and nucleus seed production; ➢ Main characteristics of released and notified varieties, hybrids and parental lines; ➢ PGMS and TGMS; ➢ 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; ➢ DUS testing and descriptors in major crops; ➢ Variety release proposal formats in different crops
Course Outcomes	**CO1:** Describe procedures involved in varietal development, release, and notification systems. **CO2:** Apply maintenance breeding techniques to preserve genetic purity of released varieties.

	CO3: Analyze seed chain systems and varietal deterioration factors affecting seed quality. **CO4:** Evaluate maintenance breeding practices for ensuring varietal stability and uniformity.
Suggested Readings	Agarwal RL. 1997. Seed Technology. 2nd Ed. Oxford & IBH. Kelly AF. 1988. Seed Production of Agricultural Crops. Longman. McDonald MB Jr and Copeland LO. 1997. Seed Production: Principles and Practices. Chapman & Hall. Poehlman JM and Borthakur D. 1969. Breeding Asian Field Crops. Oxford & IBH. Singh BD. 2005. Plant Breeding: Principles and Methods. Kalyani. 2015 Thompson JR. 1979. An Introduction to Seed Technology. Leonard Hil

Prerequisite	Basic biology and genetics.
Rationale	Biotechnology provides modern tools for crop and biological improvement.
Course Title	**Principles of Biotechnology**
Credits	3 (3+0)
Objectives of the course	1. To understand principles of biotechnology. 2. To study applications in agriculture. 3. To learn recombinant DNA technology basics. 4. To develop awareness of biotechnological advancements.
Syllabus	
Theory	**Unit I** (12 Lectures) History, scope and importance of Biotechnology; Specializations in Agricultural Biotechnology: Genomics, Genetic engineering, Tissue Culture, Bio-fuel, Microbial Biotechnology, Food Biotechnology etc. Basics of Biotechnology, Primary metabolic pathways, Enzymes and its activities. **Unit II** (16 Lectures) Structure of DNA, RNA and protein, their physical and chemical properties. DNA function: Expression, exchange of genetic material, mutation. DNA modifying enzymes and vectors; Methods of recombinant DNA technology; Nucleic acid hybridization; DNA/RNA libraries; Applications of gene cloning in basic and applied research, Plant transformation: Gene transfer methods and applications of GM crops. **Unit III** (8 Lectures) Molecular analysis of nucleic acids -PCR and its application in agriculture and industry, Introduction to Molecular markers: RFLP, RAPD, SSR, SNP etc, and their applications; DNA sequencing, different methods; Plant cell and tissue culture techniques and their applications.Introduction to genomics, transcriptomics, ionomics, metabolomics and proteomics. Plant cell and tissue culture techniques and their applications. **Unit IV** (12 Lectures) Introduction to Emerging topics: Genome editing, gene silencing, Plant microbial interactions,Success stories in Biotechnology, Careers and employment in biotechnology. Public perception of biotechnology; Bio-safety and bioethics issues; Intellectual property rights in biotechnology.
Practical	
Course Outcomes	**CO1:** Explain the principles and applications of biotechnology in agriculture and allied sciences. **CO2:** Apply basic biotechnological techniques used in crop improvement and research. **CO3:** Analyze the role of biotechnology in sustainable agricultural development. **CO4:** Evaluate the advantages and limitations of biotechnology applications in agriculture.
Suggested Readings	Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R. 2014. Molecular Biology of the Gene, 7th edition, Cold Spring Harbor Laboratory Press, New York • Brown T A. 2010. Gene Cloning and DNA analysis an Introduction 6th edition, Wiley Blackwell • Primrose SB and

	Twyman R. 2006. Principles of gene Manipulation 7th edition, Wiley Blackwell. Singh BD. 2012. Biotechnology: Expanding Horizons 4th edition, Kalyani publisher, New Delhi, India

Prerequisite	Students should have basic knowledge of statistics, data analysis, and elementary mathematical concepts at the undergraduate level.
Rationale	Experimental design is a fundamental component of scientific research in agricultural and allied sciences. Proper planning, layout, and statistical analysis of experiments improve precision, reduce experimental error, and ensure reliable interpretation of research findings. This course provides essential knowledge of experimental designs and analysis techniques widely used in agricultural research.
Course Title	**Experimental Designs**
Credits	3(2+1)
Objectives of the course	1. To impart knowledge on the principles and importance of experimental design in scientific research. 2. To explain different experimental designs and their statistical analysis procedures. 3. To develop understanding of factorial experiments, confounding, covariance analysis, and incomplete block designs. 4. To provide practical exposure in layout planning, analysis, and interpretation of experimental data.
Syllabus	
Theory	**Unit I** Need for designing experiments; characteristics of a good design; basic principles of experimental design – randomization, replication and local control. **Unit II** Uniformity trials; size and shape of plots and blocks; analysis of variance; Completely Randomized Design (CRD), Randomized Block Design (RBD) and Latin Square Design (LSD). **Unit III** Factorial experiments (symmetrical as well as asymmetrical); orthogonality and partitioning of degrees of freedom; concept of confounding. **Unit IV** Split plot and strip plot designs; analysis of covariance and missing plot techniques in randomized block and Latin square designs; transformations; Balanced Incomplete Block Design (BIBD), resolvable designs and their applications; lattice design and alpha design – concepts, randomization procedures, analysis and interpretation of results; response surface methodology; combined analysis.
Practical	➢ Analysis of uniformity trial data ➢ Formation of plots and blocks ➢ Fairfield Smith Law ➢ Analysis of data obtained from CRD, RBD and LSD ➢ Analysis of factorial experiments

	➢ Analysis with missing data ➢ Analysis of split plot and strip plot designs
Course Outcomes	**CO1**: Explain the need, principles, and characteristics of experimental designs used in agricultural and applied science research. **CO2**: Apply appropriate experimental designs such as CRD, RBD, LSD, factorial, split plot, and strip plot designs for research experiments. **CO3**: Analyze experimental data using ANOVA, covariance analysis, confounding techniques, and incomplete block designs. **CO4**: Interpret experimental results and perform practical data analysis for scientific research and decision-making.
Suggested Readings	1. Experimental Designs. 1957. 2nd Ed. John Wiley. 2. Design and Analysis of Experiments. 1999. Springer. 3. Design and Analysis of Experiments. 2012. 8th Ed. John Wiley. 4. Experimental Designs. 1985. MacMillan. 5. Design and Analysis of Experiments. 1953. Oliver & Boyd. 6. Handbook on Analysis of Agricultural Experiments. 1979. IASRI Publications. 7. The Agricultural Field Experiment. 1983. John Wiley. 8. ICAR Directorate of Research Services

Prerequisite	Students should possess basic knowledge of academic communication, information resources, and computer applications. Familiarity with internet usage and elementary research methodology will facilitate effective understanding of library systems and information retrieval techniques.
Rationale	The course is designed to acquaint students with modern library systems, information sources, and digital resource management essential for higher education and research. It enables learners to develop competencies in literature search, referencing, citation practices, and utilization of electronic information resources. The course also promotes information literacy skills necessary for academic writing, research documentation, and efficient access to scientific knowledge in the digital era.
Course Title	**Library and Information Services**
Credits	1(0+1)
Objectives of the course	1. To familiarize students with the structure, functions, and services of libraries in education and research. 2. To develop understanding of various information sources, indexing, and abstracting services used in scientific research. 3. To enhance skills in literature survey, citation techniques, bibliography preparation, and information retrieval. 4. To enable students to effectively use digital library resources, online databases, internet tools, and e-resources for academic purposes.
Syllabus	
Theory	-
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 Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/ Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; resources access methods.
Course Outcomes	**CO1:** Explain the role, functions, and organization of libraries and classify different sources of scientific information. **CO2:** Describe abstracting, indexing, and citation services and interpret their significance in academic and research activities. **CO3:** Apply literature survey methods, reference management techniques, and bibliography preparation in scholarly work. **CO4:** Demonstrate the use of digital library tools, online databases, internet search engines, and e-resource access methods for efficient information retrieval.
Suggested Readings	-

Prerequisite	Students should possess basic knowledge of laboratory practices, elementary chemistry, biology, and plant sciences acquired at the undergraduate foundation level. Familiarity with common laboratory instruments, solution preparation, and safety protocols will facilitate effective understanding of practical laboratory operations and experimental techniques.
Rationale	This course is designed to develop essential laboratory competencies and technical skills required in agricultural and biological sciences. It provides hands-on training in laboratory safety, handling of chemicals and instruments, preparation of solutions and media, sterilization techniques, and basic biotechnological procedures. The course enhances students' practical proficiency, accuracy in experimentation, and scientific handling of laboratory resources necessary for research and field applications.
Course Title	**Basic Concepts in Laboratory Techniques**
Credits	1(0+1)
Objectives of the course	1. To familiarize students with laboratory safety procedures and proper handling of chemicals, glassware, and scientific instruments. 2. To develop practical skills in preparation of solutions, buffers, media, and agro-chemical formulations for laboratory and field applications. 3. To impart knowledge and hands-on training in sterilization techniques, viability testing, and tissue culture methods in crop plants. 4. To enable students to apply standard laboratory methodologies and botanical terminology in scientific experimentation and plant description.

Syllabus	
Theory	-
Practical	➢ Safety measures while in Lab; ➢ Handling of chemical substances; ➢ Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; ➢ Washing, drying and sterilization of glassware; ➢ Drying of solvents/ chemicals; ➢ Weighing and preparation of solutions of different strengths and their dilution; ➢ Handling techniques of solutions; ➢ Preparation of different agro-chemical doses in field and pot applications; ➢ Preparation of solutions of acids; ➢ Neutralisation of acid and bases; ➢ Preparation of buffers of different strengths and pH values; ➢ Use and handling of microscope, laminar flow, vacuum pumps, viscometer, ➢ thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; ➢ Electric wiring and earthing; ➢ Preparation of media and methods of sterilization; ➢ Seed viability testing, testing of pollen viability; ➢ Tissue culture of crop plants; ➢ Description of flowering plants in botanical terms in relation to taxonomy.
Course Outcomes	**CO1:** Explain laboratory safety measures, chemical handling procedures, and the operational principles of common laboratory instruments and equipment. **CO2:** Demonstrate the preparation, dilution, neutralization, and handling of chemical solutions, buffers, acids, and agro-chemical doses using standard laboratory techniques. **CO3:** Apply sterilization methods, media preparation techniques, seed and pollen viability testing, and tissue culture practices in laboratory experiments. **CO4:** Analyze and interpret botanical characteristics of flowering plants using standard taxonomic terminology and scientific laboratory practices.
Suggested Readings	1. Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press. Common Academic Regulations for PG and Ph.D. Programmes Restructured and Revised Syllabi of Post-graduate Programmes Vol. 2 2. Gabb MH and Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co.