

MGM UNIVERSITY, AURANGABAD
INSTITUTE OF BIOSCIENCES AND TECHNOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Basic & Applied Science
Post Graduate (PG) programme
Plant Breeding & Molecular Genetics
w. e. f. Academic Year 2021-22
M.Sc. Plant Breeding & Molecular Genetics

SEMESTER-I
CURRICULUM

M.Sc. Plant Breeding and Molecular Genetics

Semester I																		
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing						Credit
						Internal			External		Total	Internal			External		Total	
(Mandatory)			L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	TW	ESE	PR		Total
MPB-111	Principles of Genetics and Plant Breeding	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPB-112	Principles of Cytogenetics	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPB-113	Molecular Cell Biology	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPB-114	Plant Physiology and Development	Theory	4			20	20		60		100	-	-	-	24	-	40	4
PBL-115	Breeding Farming (Practical)	Practical			4			40		60	100	-	-	16		24	40	2
PBL-116	Breeding Lab (Practical)	Practical			2			20		30	50	-	-	8		12	20	1
PBL-117	Mini Project	Practical			4			40		60	100	-	-	16		24	40	2
PBL-118	Seminar	Practical			1			20		30	50	-	-	8		12	20	1
PBL-119	Open Elective Course	Practical			1			20		30	50	-	-	8		12	20	1
	Total		16		12	80	80	140	240	210	750	0	0	56	96	84	300	23

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work

SYLLABUS STRUCTURE SHEET

Principal of Genetics & Plant Breeding

University: MGM University, Aurangabad

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** M. Sc Plant Breeding & Molecular Genetics

Course Unit Code: MPB-111 **Course Unit Title:** Principal of Genetics & Plant Breeding

Credits allocated: 4 (4 Theory+0 Practical) **Level of Study:** PG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs / weekly

Recommended Year /Semester: Plant breeding molecular genetics-Master of Science, Year 1/
Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form.

Candidate should pass in under graduate life science.

Learning Outcomes

Upon successful completion, students will have the knowledge and skills to:

1. General structure and constituents of cell, Similarities and distinction of plant and animal cells
2. Organellar genomes and their manipulation
4. Genetics & Plant Breeding

Objective:

1. This course is aimed at understanding the basic concepts of genetics, helping students to develop their analytical, quantitative and problem solving skills from classical to molecular genetics.
2. To impart theoretical knowledge and practical skills about plant breeding objectives, modes of reproduction and genetic consequences, breeding methods for crop improvement.

COURSE CONTENTS

THEORY

UNIT I

Beginning of genetics; Cell structure and cell division; 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

Genetic fine structure analysis, Allelic complementation, Split genes, Transposable genetic elements, Overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters.

UNIT III

History of Plant Breeding (Pre and post-Mendelian era); Objectives of plant breeding, characteristics improved by plant breeding; Patterns of Evolution in Crop Plants Centres of Origin-biodiversity and its significance. Genetic basis of breeding self- and cross - pollinated crops including mating systems and response to selection - 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; Plant introduction and role of plant genetic resources in plant breeding.

UNIT IV

Pure line theory, pure line selection and mass selection methods; Line breeding, pedigree, bulk, backcross, single seed descent and multiline method; Population breeding in self- pollinated crops

(diallel selective mating approach).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 interpopulation improvement and development of synthetics and composites; Hybrid breeding - genetical and physiological basis of heterosis and inbreeding, production of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance; seed production of hybrid and their parent varieties/inbreds.

UNIT V

Breeding methods in asexually/clonally propagated crops, clonal selection apomixes, clonal selection.Cultivar development- testing, release and notification, maintenance breeding, Participatory Plant Breeding, Plant breeders’ rights and regulations for plant variety protection and farmers rights.

Suggested Readings/ Reference Books / Text Books

1. Gardner EJ &Snustad DP. 1991. Principles of Genetics. John Wiley & Sons.
2. Klug WS & Cummings MR. 2003. Concepts of Genetics. Peterson Edu.
3. Lewin B. 2008. Genes IX.
4. Jones & Bartlett Publ.Russell PJ. 1998. Genetics. The Benzamin/Cummings Publ. Co.
5. Snustad DP & Simmons MJ. 2006. Genetics. 4th Ed. John Wiley & Sons.
6. Strickberger MW. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India
7. Tamarin RH. 1999. Principles of Genetics. Wm. C. Brown Publs.
8. Uppal S, Yadav R, Subhadra& Saharan RP. 2005. Practical Manual on Basic and Applied Genetics.
9. Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons.
- 10.Chopra VL. 2001. Breeding Field Crops. Oxford & IBH.
- 11.Chopra VL. 2004. Plant Breeding. Oxford & IBH.
- 12.Gupta SK. 2005. Practical Plant Breeding. Agribios.
- 13.Pohlman JM &Bothakur DN. 1972. Breeding Asian Field Crops. Oxford & IBH.
- 14.Roy D. 2003. Plant Breeding, Analysis and Exploitation of Variation.
- 15.Sharma JR. 2001. Principles and Practice of Plant Breeding. Tata McGraw-Hill.
- 16.Simmonds NW. 1990. Principles of Crop Improvement.
- 17.Singh BD. 2006. Plant Breeding.
- 18.Kalyani.Singh P. 2002. Objective Genetics and Plant Breeding.
- 19.Kalyani.Singh P. 2006. Essentials of Plant Breeding. 20.Kalyani.Singh S & Pawar IS. 2006. Genetic Bases and Methods of Plant Breeding

Assessment Method:

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4 Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

PRINCIPLES OF CYTOGENETICS

University: MGM University, Aurangabad

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: MPB-112

Course Unit Title: Principles Of Cytogenetics

Credits allocated: 4 (4 Theory+0 Practical)

Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs / weekly

Recommended Year /Semester: Plant Breeding & Genetics -Master of Science, Year 1/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form.

Candidate should pass in under graduate life science.

Learning Outcomes: On completion of the course, students are able to understand

Theoretical knowledge and computation skills regarding component of variation and variances, scales, mating designs and gene effects and explain in details 1. Mendelian traits vs polygenic traits 2. Principles of Analysis of Variance (ANOVA), Designs for plant breeding experiments 3. Generation mean analysis 4. QTL mapping; Strategies for QTL mapping

Objective:

To provide insight into structure and functions of chromosomes, chromosome mapping, polyploidy and cytogenetic aspects of crop evolution. To provide a working knowledge of Cytogenetics, the preparation of materials for study, and the importance of chromosomal variations in structure and number in such fields as plant and animal breeding, population genetics, evolutionary genetics, taxonomy, and the medical sciences

COURSE CONTENTS

THEORY

UNIT I

Architecture of chromosome in prokaryotes and eukaryotes; Chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; Artificial chromosome construction and its uses; Special types of chromosomes.

UNIT II

Chromosomal theory of inheritance – Cell Cycle and cell division – mitosis and meiosis; Differences, significance and deviations – Synapsis, structure and function of synaptonemal complex and spindle apparatus, anaphase movement of chromosomes and crossing over-mechanisms and theories of crossing over- recombination models, cytological basis, - Variation in chromosome structure: Evolutionary significance - Introduction to techniques for karyotyping; Chromosome banding and painting - in situ hybridization and various applications.

UNIT III

Structural and Numerical variations of chromosomes and their implications Symbols and terminologies for chromosome numbers - euploidy - haploids, diploids and polyploids; Evolutionary significance of chromosomal aberrations - balanced lethals and chromosome complexes.

UNIT IV

Inter-varietal chromosome substitutions; Polyploidy and role of polyploids in crop breeding; Evolutionary advantages of autopolyploids vs allopolyploids—Role of aneuploids in basic and applied aspects of crop breeding, their maintenance and utilization in gene mapping and gene blocks transfer – Alien addition and substitution lines – creation and utilization; Apomixis - Evolutionary and genetic problems in crops with apomixes.

UNIT V

Reversion of autopolyploid to diploids; Genome mapping in polyploids - Interspecific hybridization and allopolyploids; Synthesis of new crops (wheat, triticale and brassica) – Hybrids between species with same chromosome number, alien translocations - Hybrids between species with different chromosome number; Gene transfer using amphidiploids - Bridge species. Fertilization barriers in crop plants at pre-and post fertilization levels- In vitro techniques to overcome the fertilization barriers in crops; Chromosome manipulations in wide hybridization ; case studies – Production and use of haploids, diploids and doubled haploids in genetics and breeding.

Suggested Readings/ Reference Books / Text Books

1. Becker K & Hardin. 2004. The World of Cell. 5th Ed. Pearson Edu.
2. Carroll M. 1989. Organelles. The Guilford Press.
3. Charles B. 1993. Discussions in Cytogenetics. Prentice Hall.14
4. Darlington CD & La Cour LF. 1969. The Handling of Chromosomes.
5. Elgin SCR. 1995. Chromatin Structure and Gene Expression. IRL Press.
6. Gray P. 1954. The Microtomeist’s Formulary Guide. The Blakiston Co.
7. Gupta PK & Tsuchiya T. 1991. Chromosome Engineering in Plants: Genetics, Breeding and Evolution. Part A. Elsevier.
8. Gupta PK. 2000. Cytogenetics. Rastogi Publ.
9. Johannson DA. 1975. Plant Microtechnique.
10. Karp G. 1996. Cell and Molecular Biology: Concepts and Experiments.
11. Khush GS. 1973. Cytogenetics of Aneuploids. Academic Press.
12. Sharma AK & Sharma A. 1988. Chromosome Techniques: Theory and Practice.
13. Butterworth. Sumner AT. 1982. Chromosome Banding. Unwin Hyman Publ.
14. Swanson CP. 1960. Cytology and Cytogenetics. Macmillan & Co

Assessment Method:

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4 Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

MOLECULAR CELL BIOLOGY

University: MGM University, Aurangabad

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: MPB-113

Course Unit Title: Molecular Cell Biology

Credits allocated: 4 (4 Theory+0 Practical) **Level of Study:** PG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs / weekly

Recommended Year /Semester: Plant breeding molecular genetics-Master of Science, Year 1/ Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form.

Candidate should pass in under graduate life science.

Learning Outcomes

Upon successful completion, students will have the knowledge and skills to:

1. General structure and constituents of cell,
2. Similarities and distinction of plant and animal cells
2. Structure and function of major organelles
3. Organellar genomes and their manipulation
4. Cell division and regulation of cell cycle

Objective: To familiarize the students with the cell biology at molecular level.

COURSE CONTENTS

THEORY

Unit I

The Mendelian View of the World: Mendel's Discoveries, Chromosomal Theory of Heredity, the origin of genetic variability through mutation, early speculation about what genes are & how they act, preliminary attempts to find a gene-protein relationship.

Nucleic Acids Convey Genetic Information: Avery's Bombshell: DNA, The Duplex Helix, The Genetic Information Within DNA is Conveyed by the Sequence of its Four Nucleotide Building Blocks, The Central Dogma, Establishing the direction of protein synthesis, the era of genomics.

Importance of Weak Chemical Interaction: Characteristic of chemical bonds, the concepts of free energy, weak bonds in biological systems.

Importance of High Energy Bonds: Molecules that donate energy are thermodynamically unstable, Enzymes lower activation energies on biochemical reaction, free energy in biomolecules, High energy Bonds in biosynthetic reactions, activation of precursors in group transfer reactions.

Weak & Strong Bonds Determine Macromolecular structure: Higher- order structures are determined by intra and intermolecular interactions, specific confirmation of a protein results from its pattern of Hydrogen Bonds, most proteins are Modular, containing two or three Domains, Weak Bonds Correctly position proteins along DNA & RNA Molecules, Allostery: Regulation of a proteins function by changing its shape.

Structure of DNA & RNA: DNA Structure, DNA Topology, RNA Structure.

Chromosome, Chromatin, & Nucleosome: Chromosome Sequence and Diversity, Chromosome Duplication & Segregation, the Nucleosome, Higher -Order Chromatin Structure, Regulation of chromatin Structure.

UNIT II

Replication of DNA: Chemistry of DNA Synthesis, Mechanism of DNA Polymerase, Replication Fork, Specialization of DNA Polymerase, DNA Synthesis at the Replication Fork, Initiation of DNA Replication, Binding & Unwinding: origin selection & activation by the initiation protein, Finishing Replication.

The Mutability & Repair of DNA: Replication errors & their repair, DNA Domain, Repair of DNA Damage.

Homologous Recombination at the Molecular Level: Models for Homologous Recombination, Homologous Recombination Protein Machines, Homologous Recombination in Eukaryotes, Mating-Type Switching, Genetic Consequences of the mechanism of homologous recombination.

Site-Specific Recombination & Transposition of DNA: Conservative Site-Specific Recombination, Biological Roles of Site-Specific Recombination, Transposition, Examples of Transposable Elements & their Regulation, V(D)J Recombination.

UNIT III:

Mechanism of Transcription: RNA Polymerases & the Transcription Cycle, Transcription cycle in Bacteria, Transcription in Eukaryotes.

RNA Splicing: The Chemistry of RNA Splicing, Spliceosome Machinery, Splicing Pathway, Alternative Splicing Exon Shuffling, RNA Editing, mRNA Transport.

Translation: Messenger RNA, Transfer RNA, Attachment of Amino Acids to tRNA, The Ribosome, Initiation of Translation, Translation Elongation, Termination of Translation, Translation, Different Regulation of mRNA & Protein Stability.

The Genetic Code: the code is degenerate, three rules govern the genetic code, suppressor mutation or a different gene, the codes are nearly universal.

UNIT IV:

Gene Regulation in Prokaryotes: Principles of Transcriptional Regulation, Regulation of Transcription Initiation: Examples from Bacteria, Example of Gene Regulation at Steps after Transcription Initiation, The Case Phage Lambda: Layer of Regulation.

Gene Regulation in Eukaryotes: Conserved Mechanisms of Transcriptional Regulation from Yeast to Mammals, Recruitment of Protein Complexes to Gens by Eukaryotic Activator’s, Signal Integration & Combinatorial Control, Transcriptional Repressors Signal Transduction & the Control of Transcriptional Regulators, Gene “ SILENCING” by Modification of Histones &DNA, Eukaryotic Gene Regulation at steps after transcription initiation, RNAs in Gene Regulation.

Gene Regulation during Development: Three strategies by which cells are instructed to express specific sets of gens during development, Example of the three strategies for establishing differential gene expression, the molecular biology of Drosophila Embryogenesis.

Comparative Genomic & the Evolution of Animal Diversity: Most animals have essentially the same genes, three ways gene expression is changed during evolution , Experimental manipulations that alter animal morphology, morphological changes in crustaceans & insects, genome evolution & human origins.

UNIT V:

Techniques of Molecular Biology: Introduction, Nucleic Acids, Proteins.

Model Organisms: Bacteriophage, Bacteria, Baker’s Yeast-*Saccharomyces cerevisiae*, Nematode Worm-*Caenorhabditis elegans*, The Fruit Fly-*Drosophila melanogaster*, The House Mouse-*Mus musculus*.

Stem Cells and Tissue Renewal: Stem Cells and Renewal in Epithelial Tissues, Fibroblasts and Their Transformations :the Connective-Tissue Cell Family, Genesis and Regeneration of Skeleta l Muscle, Blood Vessels, Lymphatics , and Endothelial Cells, A Hierarchical Stem-Cell System: Blood CellFormation, Regenerati on and Repair, Cell Reprogramming and Pluripotent Stem Cells.

Pathogens and Infection: introduction to pathogens and the humanmicrobiota, cell biology of infection,

Suggested Readings/ Reference Books / Text Books

1. Molecular Biology of Gene by Watson, Baker, Bell
2. Lodish, et al. Molecular Cell Biology. 5th ed. New York, NY: W.H. Freeman and Company, 2003. ISBN: 9780716743668.
3. Hardin, J, and Bertoni, G.P. 2015. Becker’s World of the Cell, 9th edition, Pearson
4. Bruce Alberts, et al. Molecular biology of the cell. Garland Science, 2015. 6th edition.
5. Alberts, Bray, Hopkin, Johnson, Lewis, Raff, Roberts, and Walter. 2014. Essential Cell Biology 4th ed. Garland Science. ISBN: 978-0-8153-4454-4.

Assessment Method:

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4. Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

Plant Physiology & Development

University: MGM University, Aurangabad **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences and Tech **Degree:** M.Sc. Plant Breeding & Molecular genetics

Course Unit Code: MPB-114 **Course Unit Title:** Plant Physiology and Development

Credits allocated: 4+0 (4Theory+0 Practical) **Level of Study:** PG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs weekly

Recommended Year /Semester: Plant Breeding & Molecular Genetics Master's of Science, Year 1/ I Semester

Prerequisites for Registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidate should pass in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive exposure to the subject of plant physiology. The laboratory exercises provide hands-on experiences with experiments and training in instrumental skills. Topics include: water relations, photosynthesis, inorganic nutrition, metabolism of organic materials, and plant growth regulation, with emphasis on environmental factors in the physiology of plants.

Objective:

By the end of this course, the student will be able to:

1. Comprehend the fundamental concepts of plant physiology
2. Describe the physiological mechanisms of plant growth, function, and development
3. Recognize and describe how plants respond to their environment

COURSE CONTENTS

THEORY

Unit I: Cell and Water

Cell organelles and their physiological functions, structure and physiological functions of cell wall, cell inclusions; cell membrane structure and functions.

Soil and plant water relations, water and its role in plants, properties and functions of water.

Water relations-cell water terminology, water potential of plant cells.

Water loss from plants-Energy balance-Solar energy input-energy dissipation at crop canopy level-evapotranspiration .

Transpiration –Driving force for transpiration, plant factors influencing transpiration rate, Mycorrhizal association on water uptake.

Stomata structure and function – mechanism of stomatal movement

Antitranspirants.

Unit II: Physiology of water stress in plants

Physiology of water stress in plants: Influence of water stress at cell, organ, plant and canopy levels. Indices for assessment of drought resistance.

Uptake of mineral elements in plants –Mechanisms of uptake-translocation of minerals in plants. The role of mineral nutrients in plant metabolism, critical levels, deficiency symptoms, nutrient deficiency and toxicity.

Foliar nutrition

Unit III: Plant Biochemistry and Plant Metabolism,

Photosynthesis and its importance in bio productivity. Photochemical process, photochemical reactions, CO₂ reduction in Calvin cycle, supplementary pathway of C fixation in C₄ and CAM plants and its significance.

Photorespiration and its relevance. Photosynthesis as a diffusive process effect of environmental factors on photosynthetic rates

Translocation of photosynthates and its importance in sink growth

Mitochondrial respiration, growth and maintenance respiration, cyanide resistant respiration and its significance. Nitrogen metabolism: Inorganic nitrogen species (N₂, NO₃ and NH₃) and their reduction to aminoacids,

Protein synthesis and nucleic acids.

UNIT IV: Growth and Development, Photo-morphogenesis:

Growth and differentiation. Hormonal concept of growth and differentiation, plant growth hormones and their physiological role. Synthetic growth regulators, growth retardants.,

Unit V Photo-morphogenesis:

Apical dominance, senescence, fruit growth, abscission. Photo-morphogenesis: Photo receptors, phytochrome, cryptochrome, Physiology of flowering- Photo-periodism and Vernalisation.

Suggested Readings/ Reference Books / Text Books

1. Hopkins WG & Huner NPA. 2004. Introduction to Plant Physiology. John Wiley & Sons.
2. Salisbury FB & Ross C. 1992. Plant Physiology. 4th Ed. Wadsworth Publ.
3. Taiz L & Zeiger E. 2006. Plant Physiology. 4th Ed. Sinauer Associates.
4. Gupta N K & Gupta S. 2005. Plant Physiology. Oxford and IBH, New Delhi

Assessment Method:

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40 maintenance

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 4) out of 5Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

SYLLABUS STRUCTURE SHEET
Breeding farming Practical

University: MGM University, Aurangabad **Faculty:** Basic and Applied Sciences
Institute: Institute of Biosciences and Tech. **Degree:** M.Sc. Plant Breeding & Molecular Genetics
Course Unit Code: MPB-115 **Course Unit Title:** Breeding Farming Practical
Credits allocated: 2 (0Theory+2 Practical) **Level of Study:** PG
Mode of delivery, planned learning activities and teaching method: Practical 6 hrs weekly

Sr. No	Cytogenetics and Plant Breeding practical	No of practical
1	Study of floral biology in self pollinated crops	2
2	Study of floral biology in cross pollinated crops	2
3	Methods of Emasculation in Okra	1
4	Study of Anthesis stages in different crops	4
5	Visit to seed production plots and different field crops and submission of report.	2
6	Study of pollen germination in crop plants	1
7	Study of pollen viability in crop plants	2
8	Breeding methods and hybridization techniques in Rice, maize, soybean, sorghum, pearl millet, cotton, mustard	7
9	Study of male sterility in Sorghum and Bajra in field or lab by staining the pollen grain	2
10	To study about the type of ovules	1
11	To study Gametogenesis in Plants	1
12	Induction of male sterility in crops	1
13	To study self incomparability in crops	1
14	Study of heterosis breeding methods in crops	5
15	Estimation of hererosis	1
16	Induction of Mutagenesis in vegetable crops	2
17	Study the heterosis fixation methods in crops	2

18	Plant Breeder's kit, Study of germplasm of various	2
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	crops	
19	Designs used in plant breeding experiments, analysis of Randomized Block Design	2
20	To work out the mode of pollination in a given crop and extent of natural out-crossing	2

Practical Assessment for 100 marks

Components(TW)	Record Book	Table Viva	Attendance	Total Marks
Internal Marks	10	10	20	40
External Assessment: Semester End Practical				60
Total Marks				100

- **Performance** - In ongoing academic semester practicals are conducted to analyze the students whether they are gaining Practical knowledge and they are doing their practical individually.
- **Record book** -In ongoing academic semester the role of Record Book is to develop their writing skills & they have the data of practicals in it.
- **Table Viva**- Table Viva is important to build student confidence. How much students are clearer about their practical Knowledge
- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	14
2.	80	16
3.	90	18
4.	100	20

- **Internal Practical Exam:** In ongoing academic semester the Internal Practical Exam are conducted to check their practical skills and techniques Usually in laboratory. They will be better placed to perform well in a practical exam if they can report their methodology and observations accurately.

Practical Assessment for 100 marks

Components(TW)	Record Book	Table Viva	Attendance	Total Marks
Internal Marks	10	10	20	40
External Assessment: Semester End Practical				60
Total Marks				100

- **Performance** - In ongoing academic semester practicals are conducted to analyze the students whether they are gaining Practical knowledge and they are doing their practical individually.

- **Record book** -In ongoing academic semester the role of Record Book is to develop their writing skills & they have the data of practicals in it.
- **Table Viva-** Table Viva is important to build student confidence. How much students are clearer about their practical Knowledge
- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	14
2.	80	16
3.	90	18
4.	100	20

- **Internal Practical Exam:** In ongoing academic semester the Internal Practical Exam are conducted to check their practical skills and techniques Usually in laboratory. They will be better placed to perform well in a practical exam if they can report their methodology and observations accurately.

SYLLABUS STRUCTURE SHEET

Breeding Lab Practical

University: MGM University, Aurangabad **Faculty:** Basic and Applied Sciences

Institute: Institute of Biosciences and Tech. **Degree:** M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: MPB-116

Course Unit Title: Breeding Lab Practical

Credits allocated: 1+0 (0Theory+1Practical)

Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Practicals 6 hrs weekly

1	To demonstrate the process of osmosis with the help of Potato Osmoscope.
2	Determination of pollen fertility.
3	To understand the karyotyping.
4	To study the Staining methods.
5	To determine the seed viability.
6	Determine the rate of seed germination.
7	Estimation of chlorophyll from leaf samples.
8	To study the Monohybrid, Dihybrid and Trihybrid test ratios.
9	Extraction of DNA and RNA from given samples.
10	Agarose Gel Electrophoresis.
11	Polymerase Chain Reaction.
12	Study the blotting techniques and different markers.
13	Methods of Isolation, Purification and Maintenance of Micro-organism from different environment.
14	Isolation of Rhizobium from nodule and Gram Staining of Rhizobial cells.

Practical Assessment for 50 marks

Components(TW)	Record Book	Table Viva	Attendance	Total Marks
Internal Marks	5	5	10	20
External Assessment: Semester End Practical				30
Total Marks				50

- **Performance** - In ongoing academic semester practicals are conducted to analyze the students whether they are gaining Practical knowledge and they are doing their practical individually.
- **Record book** -In ongoing academic semester the role of Record Book is to develop their writing skills & they have the data of practicals in it.
- **Table Viva**- Table Viva is important to build student confidence. How much students are clearer about their practical Knowledge

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

- **Internal Practical Exam:** In ongoing academic semester the Internal Practical Exam are conducted to check their practical skills and techniques Usually in laboratory. They will be better placed to perform well in a practical exam if they can report their methodology and observations accurately.

MINI PROJECT

University: MGM University, Aurangabad **Faculty:** Basics& Applied Sciences
Institute: Institute of Biosciences and Tech. **Degree:** M.Sc. Plant Breeding & Molecular Genetics
Course Unit Code: PBL-117 **Course Unit Title:** Mini Project
Credits allocated: 2 (2Practical+ 0 Theory) **Level of Study:** PG

Mode of delivery, planned learning activities and teaching method: Practical 3 hrs / weekly

Recommended Year /Semester: M.Sc. Plant Breeding & Molecular Genetics Year I/ Semester I

Course Outcomes:

1. Students will be able to practice acquired knowledge within the chosen area of technology for project development.
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

Ideas of project:

Defining project ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.

Literature survey:

A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.

Performance:

Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.

1. Implementation:

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2. Evaluation:

Clearly relates to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3. Project Log:

- a. The individual student's effort and commitment.
- b. The quality of the work produced by the individual student.
- c. The student's integration and co-operation with the rest of the group.
- d. The completeness of the logbook & time to time signature of guide

Objective: To elaborate the procedure for Guiding Student projects

Responsibility:

- All the Project Guide.
- All Semester M.Sc. students
- Project Heads

Procedure:

Sr.	Activities	Responsibility
1.	UG students are to decide on their team members for their semester project with their proposed project domain and title.	PG students, Project Head.
2.	Director shall allocate the Project Guide based on their area of expertise (not more than 3 batches to a Guide)	Director
3.	Ensuring that students have regular discussion meetings with their Project guides.	Project Guide, Project Head
4.	Synopsis preparation and pre submission	project head
4.	Verification of Student project log book.	Project Head and Project Guide.
5.	Approval of PPT: Abstract, Existing, Proposed system. 30% of proposed work. 80% of proposed work. 100% of proposed work.	Project Guide

6.	Preparation and submission of progress report during project	Students, Project Head.
7.	Preparing list for Redo students (Insufficient content, Plagiarism, poor presentation Genuine Absentees)	Project Heads
8.	Submission of hard copy of Project report	Project Head
9.	Evaluation of Project report	External Examiner
8.	Organizing final project viva-voce.	Project Heads
9.	Ensuring that if a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.	Project Head, Project Guide, Director
10.	Collecting copies of the approved project report after the successful completion of viva examinations.	Project Head.

Project Assessment (100 Marks)

Idea Project	of Understanding of Subject	Literature survey	Attendance	Total Marks
10	10	10	10	40
External Assessment				60
Total Marks				100

Ideas of project:

Defining projects ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.

Literature survey:

A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.

Performance:

Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.

1. Implementation:

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2. Evaluation:

Clearly relates solution to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3. Project Log:

- a. The individual student's effort and commitment.
- b. The quality of the work produced by the individual student.
- c. The student's integration and co-operation with the rest of the group.
- d. The completeness of the logbook & time to time signature of guide

- **Attendance:**

In ongoing semester attendance are important for students. They are expected to do their project in the semester that is timetabled. The criteria of attendance are given below.

Sr.No.	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

Project External Assessment (Marks distribution):60

External Assessment: Semester End Project Examination						
Components	Project Report	PowerPoint Presentation	Viva Voce	Innovativeness	Individual Contribution	Total
	10	10	10	20	10	60
Total marks						100

SYLLABUS STRUCTURE SHEET SEMINAR

University: MGM University, Aurangabad

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** M. Sc Plant Breeding & Molecular genetics

Course Unit Code: PBL-118

Course Unit Title: Seminar

Credits

0+1

Level of Mode of planned activities method:
weekly

Seminar Topic	Understanding of Subject	Presentation	Attendance	Total Marks
05	05	05	05	20
External Assessment:				30
Total Marks				50

allocated:
(Practical)

of Study: PG
delivery, learning and teaching
Practical 3 hrs /

Recommended Year /Semester: M.Sc. Plant Breeding & Molecular Genetics

Year I/ Semester I

Course Outcomes:

1. The purpose of a seminar is to create an experience of working together.
2. One of the main objectives of conducting seminars is to avoid a passive experience everyone should have a way to contribute and communication and also stage daring Improves.

- 1) The allotted faculty will notify about seminar conduction to the students of respective class.
- 2) The seminar topics will be listed by the students initially based on their topic of interest.
- 3) The seminar topics will be discussed with the faculty for finalizing the topic.
- 4) The finalized seminar topics will be displayed on the notice board with Director's approval.
- 5) The students will prepare the seminar topics; PPT and word file in allotted hours.
- 6) The final seminar presentation will be done by the students according t the exam date scheduled by the University,
- 7) Evaluation of the final seminar presentation and the word file will be done by the external examiner allotted by the University.

SEMINAR ASSESMENT (Marks distribution): 50

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below. (Equal weightage of percentage to marks is given)

Sr. No	Percentage of attendance	Marks
1.	70	2
2.	80	3
3.	90	4
4.	100	5

SYLLABUS STRUCTURE SHEET

Open Elective Course

University: MGM University, Aurangabad

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Technology

Degree: M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: PBL-119

Course Unit Title: Open Elective Course

Credits allocated: 0+1 (0 Theory+1Practical)

Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Lecture 3hrs / weekly

Recommended Year /Semester: Plant breeding molecular genetics-Master of Science, Year I/ Semester I.

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidates should pass in undergraduate Life Science.

- It is mandatory for undergraduate & post graduate students to undertake open elective courses for concern credits before the completion of the degree.
- Students have the option of choosing any open Elective courses under the category of mandatory elective courses.
- A student is not eligible for more than one open Elective course under the category of mandatory courses.
- For UG and PG programs the Open Electives are offered within the regular class hours.
- These courses generally earn concern credits consisting of 8 weeks-12 weeks during the completion of semester.
- Students can view the complete details of the courses offered Elective courses in their course layout.
- Till a student finishes OEC under the mandatory course category, he/she is eligible to apply for other open elective courses.
- Evaluation pattern is the discretion of the faculty concerned for UG & PG courses will be with only end semester examinations
- Examinations are conducted by the departments concerned and the results are indicated only in Grades in the marks card.
- Minimum pass percentage is 40% for courses under the mandatory category. Grades are awarded only if the student passes.
- These courses are conducted after or before the regular class hours and the courses offered are different in Odd and Even semesters.
- Students are advised to finalize their choice of programs in consultation with their OEC coordinator.
- Minimum prescribed attendance for these courses is 85%. Medical and co-curricular claim will be considered only if the student put in 75% physical attendance or the classes.
- Attendance claim shall be submitted to OEC coordinator within 07 days after availing the leave.
- Students who fail to secure the minimum pass marks or required minimum attendance or who discontinue in between the course are required to register afresh. Re-registration is permitted only in the subsequent semester which may be for the same course or any other courses from the choices available during the particular semester.
- He / She submit course syllabus weekly report on the basis of that OEC co-ordinator conduct their continuous assessment.
- A student is not eligible to graduate without completing OEC mandatory course.
- OEC offered by other departments like Performing Arts, Industrial Automation, Industry 4.0, Vastushashtra, Sketching, Hotel Management, Film Making, Python programming, Theatre and Music etc.
- Each course admits only 40 students on a first-come-first-served basis. Courses which do not get minimum required applications may not be conducted.

The Department/Centre/Office of the activity/event concerned will set the relevant parameters to measure the content of each given criterion depending on the need and application of the particular activity/event and will assess the performance of every student objectively.

Assessment of OEC (1 Credit: 50Marks)**Internal Evaluation**

Internal Assessment	10Marks
Weekly Report Submission	10Marks

- Student should register and submit joining certificate/ registered authentic document to OEC coordinator.
- Students should submit weekly report on the basis of course.
- OEC coordinator will conduct their continuous assessment for all activities during semester.

External Evaluation

Certificate Submission	30Marks
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Note: If the student unable to submit the OEC Certificate, for them there will be conduction of department (internal) examination, on the basis of open elective course syllabus submitted / selected by students.

MGM UNIVERSITY, AURANGABAD
INSTITUTE OF BIOSCIENCES AND TECHNOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Basic & Applied Science
 Post Graduate (PG) Programme
 Plant Breeding & Molecular Genetics
 w. e. f. Academic Year 2021-22
 M.Sc. Plant Breeding & Molecular Genetics

SEMESTER-II
CURRICULUM

Semester II																		
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing					Credit	
						Internal			External		Total	Internal			External			Total
			L	T	P	CA	MSE	TW	ESE	PR		CA	MS E	T W	ESE	P R		
(Mandatory)																		
MPB-121	Principles of Quantitative Genetics	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPB- 122	Mutagenesis & Mutation Breeding	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPB- 123	Maintenance Breeding, Concept of Variety Release & Seed Production	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPB- 124	Breeding for Biotic & Abiotic Stress Resistance	Theory	4			20	20		60		100	-	-	-	24	-	40	3
PBL- 125	Basics Concepts in Laboratory Techniques (Practical)	Practical			6			40		60	100	-	-	16		24	40	3
PBL-126	Plant Breeding Molecular Lab (Practical)	Practical			2			20		30	50	-	-	8		12	20	1

PBL-127	Micro Project	Pracitcal			4			40		60	100	-	-	16		24	40	2
PBL-128	Seminar	Pracitcal			1			20		30	50	-	-	8		12	20	1
PBL- 129	Open Elective Course	Pracitcal			1			20		30	50	-	-	8		12	20	1
	Total		16		4	80	80	140	240	210	750	0	0	56	96	84	300	23

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work

M.Sc. PLANT BREEDING AND MOLECULAR GENETICS

PRINCIPLES OF QUANTITATIVE GENETICS

University: MGM University, Aurangabad

Faculty: Basic & Applied Science

Institute : Institute of Biosciences and Tech.

Degree : M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: MPB-121

Course Unit Title: Principles of Quantitative Genetics

Credits Allocated : 4(4Theory+0Practical)

Level of Study : PG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs / weekly

Recommended Year /Semester: Plant Breeding & Genetics -Master of Science, Year 1/ Semester II

Prerequisites for Registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form

Outcomes: On completion of the course, students are able to understand Theoretical knowledge and computation skills regarding component of variation and variances, scales, mating designs and gene effects and explain in details 1. Mendelian traits vs polygenic traits 2. Principles of Analysis of Variance (ANOVA), Designs for plant breeding experiments 3. Generation mean analysis 4. QTL mapping; Strategies for QTL mapping

Objective: To impart theoretical knowledge and computation skills regarding component of variation and variances, scales, mating designs and gene effects.

COURSE CONTENTS

THEORY

UNIT I

Mendelian traits vs polygenic traits - nature of quantitative traits and its inheritance - Multiple factor hypothesis - analysis of continuous variation; Variations associated with polygenic traits - phenotypic, genotypic and environmental-non-allelic interactions; Nature of gene action - additive, dominance, epistatic and linkage effects.

UNIT II

Principles of Analysis of Variance (ANOVA) - Expected variance components, random and fixed models; MANOVA, bi plot analysis; Comparison of means and variances for significance.

Designs for plant breeding experiments - principles and applications; Genetic diversity analysis - metroglyph, cluster and D 2 analyses - Association analysis - phenotypic and genotypic correlations; Path analysis and Parent - progeny regression analysis; Discriminant function and principal component analyses; Selection indices - selection of parents; Simultaneous selection models- concepts of selection - heritability and genetic advance.

UNIT III

Generation mean analysis; Mating designs- Diallel, partial diallel, line x tester analysis, NCDs and TTC; Concepts of combining ability and gene action; Analysis of genotype x environment interaction - adaptability and stability; Models for Gx E analysis and stability parameters; AMMI analysis - principles and interpretation.

UNIT IV

QTL mapping; Strategies for QTL mapping - desired populations for QTL mapping - statistical methods in QTL mapping - QTL mapping in Genetic analysis; Marker assisted selection (MAS) - Approaches to apply MAS in Plant breeding - selection based on marker - simultaneous selection based on marker and phenotype - factors influencing MAS.

Suggested Reading/ Reference Books/ Text Books

1. Bos I & Caligari P. 1995. Selection Methods in Plant Breeding. Chapman & Hall.
2. Falconer DS & Mackay J. 1998. Introduction to Quantitative Genetics. Longman.
3. Mather K & Jinks JL. 1971. Biometrical Genetics. Chapman & Hall.
4. Mather K & Jinks JL. 1983. Introduction to Biometrical Genetics. Chapman & Hall.
5. Nadarajan N & Gunasekaran M. 2005. Quantitative Genetics and
6. Biometrical Techniques in Plant Breeding. Kalyani.
7. Naryanan SS & Singh P. 2007. Biometrical Techniques in Plant Breeding. Kalyani.
8. Singh P & Narayanan SS. 1993. Biometrical Techniques in Plant Breeding. Kalyani.

9. Singh RK & Choudhary BD. 1987. Biometrical Methods in Quantitative Genetics. Kalyani.
10. Weir DS. 1990. Genetic Data Analysis. Methods for Discrete Population Genetic Data. Sinauer Associates.
11. Wricke G & Weber WE. 1986. Quantitative Genetics and Selection in Plant Breeding. Walter de Gruyter.

Assessment Method

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4 Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

MUTAGENESIS AND MUTATION BREEDING

University: MGM University, Aurangabad

Institute: Institute of Bioscience and Tech.

Course Unit Code: MPB-122

Credits allocated: 4 (4Theory+0Practical)

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs / weekly

Recommended Year /Semester: Plant Breeding & Genetics -Master of Science, Year 1/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form

Faculty: Basic & Applied Science

Degree: M.Sc. Plant Breeding & Molecular Genetics

Course Unit Title: Mutagenesis & Mutation Breeding

Level of Study: PG

Outcomes: On completion of the course, students are able to understand

Knowledge about general principles of radiation and various tests/methods for detection of radiation effects on the living cells, genetic risks involved and perspectives of advances made -1. Mutation and its history - Nature and classification of mutations 2. Effect of mutations on DNA, Chemical mutagens 4. Use of mutagens in creating oligogenic and polygenic variations

Objective: To impart the knowledge about general principles of radiation and various tests/methods for detection of radiation effects on the living cells, genetic risks involved and perspectives of advances made.

3. Factors influencing the mutant spectrum:

COURSE CONTENTS

THEORY

UNIT I

Mutation and its history - Nature and classification of mutations: spontaneous and induced mutations, micro and macro mutations, pre and post adaptive mutations - Detection of mutations in lower and higher organisms – paramutations. Mutagenic agents: physical--Radiation types and sources: Ionising and non-ionising radiations viz., X-rays, γ rays, α and β particles, protons, neutrons and UV rays - Radiobiology: mechanism of action of various radiations (photoelectric absorption, Compton scattering and pair production) and their biological effects– RBE and LET relationships.

UNIT II

Effect of mutations on DNA - Repair mechanisms operating at DNA, chromosome, cell and organism level to counteract the mutation effects - Dosimetry - Objects and methods of treatment - Factors influencing mutation: dose rate, acute vs chronic irradiation, recurrent irradiation, enhancement of thermal neutron effects - Radiation sensitivity and modifying factors: External and internal sources- Oxygen, water content, temperature and nuclear volume.

Chemical mutagens- Classification - Base analogues, antibiotics, alkylating agents, acridine dyes and other mutagens: their properties and mode of action - Dose determination and factors influencing chemical mutagenesis - Treatment methods using physical and chemical mutagens – Combination treatments; Other causes of mutation - direct and indirect action, comparative evaluation of physical and chemical mutagens.

UNIT III

Observing mutagen effects in M 1 generation: plant injury, lethality, sterility, chimeras etc., - Observing mutagen effects in M 2 generation - Estimation of mutagenic efficiency and effectiveness – spectrum of chlorophyll and viable mutations – Mutations in traits with continuous variation.

Factors influencing the mutant spectrum: genotype, type of mutagen and dose, pleiotropy and linkage etc. - Individual plant based mutation analysis and working out effectiveness and efficiency in M 3 generation - Comparative evaluation of physical and chemical mutagens for creation of variability in the same species – Case studies.

UNIT IV

Use of mutagens in creating oligogenic and polygenic variations – Case studies - In vitro mutagenesis – callus and pollen irradiation; Handling of segregating generations and selection procedures; Validation of mutants; Mutation breeding for various traits (disease resistance, insect resistance, quality improvement, etc) in different crops- Procedures for micro- mutations breeding/polygenic mutations- Achievements of mutation

breeding- varieties released across the world- Problems associated with mutation breeding. Use of mutagens in genomics, allele mining, TILLING.

Suggested Reading/ Reference Books/ Text Books

1. AlperT. 1979. Cellular Radiobiology. Cambridge Univ. Press, London.
2. ChadwickKH&LeenhoutsHP.1981.TheMolecularTheoryofRadiationBiology.Springer-Verlag.
3. Cotton RGH, Edkin E & Forrest S. 2000. Mutation Detection: A Practical Approach. Oxford Univ. Press.
4. International Atomic EnergyAgency.1970.
5. Manual on Mutation Breeding. International Atomic EnergyAgency, Vienna,Italy.
6. Singh BD. 2003. Genetics.Kalyani.
7. StrickbergerMW. 2005. Genetics. 3 rd Ed. PrenticeHall.

Assessment Method :

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Master degree program.

Assessment Method

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4 Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
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1.	70	7
2.	80	8
3.	90	9
4.	100	10

MAINTENANCE BREEDING CONCEPTS OF VARIETY RELEASE & SEED PRODUCTION

University: MGM University, Aurangabad

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Tech.

Degree: Plant Breeding & Genetics (PG)

Course Unit Code: MPB-123

Course Unit Title: Maintenance Breeding Concept of Variety Release & Seed Production

Credits allocated: 4(4Theory+0Practical)

Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs / weekly

Recommended Year /Semester: Plant Breeding & Genetics -Master of Science, Year 1/ Semester II

Prerequisites for Registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form

Outcomes: On completion of the course, students are able to understand

1. Variety Development and Maintenance and DUS testing
2. Generation system of seed multiplication

Objective: To apprise the students about the variety deterioration and step to maintain the purity of varieties & hybrids and principles of seed production in self & cross-pollinated crops.

COURSE CONTENTS

THEORY

UNIT I

Variety Development and Maintenance; Definition- variety, cultivar, extant 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 for major crops; Genetic purity concept and maintenance breeding. Factors responsible for genetic deterioration 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

Generations system of seed multiplication - nucleus, breeders, foundation, certified, -Quality seed production technology of self and cross-pollinated crop varieties viz. cereals & millets (wheat, barley, paddy, pearl millet, 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 IV

Seed certification procedures; Seed laws and plant variety protection regulations in India and international systems.

Suggested Readings/ Reference Books / Text Books

1. Agarwal RL. 1997. Seed Technology. 2nd Ed. Oxford & IBH.
2. Chhabra AK. 2006. Practical Manual of Floral Biology of Crop Plants. Department of Plant Breeding. CCS HAU Hisar.

- Kelly AF. 1988. Seed Production of Agricultural Crops. Longman.
3. McDonald MB Jr & Copeland LO. 1997. Seed Production: Principles and Practices. Chapman & Hall.
 4. Musil AF. 1967. Identification of Crop and Weed Seeds. Handbook No. 219, USDA, Washington, DC.
 5. Poehlman JM & Borthakur D. 1969. Breeding Asian Field Crops. Oxford & IBH.
 6. Singh BD. 2005. Plant Breeding: Principles and Methods. Kalyani.
 7. Thompson JR. 1979. An Introduction to Seed Technology. Leonard Hill.
 8. Tunwar NS & Singh SV. 1985. Handbook of Cultivars. ICAR.

Assessment Method

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4 Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

BREEDING FOR BIOTIC AND ABIOTIC STRESS RESISTANCE

University: MGM University, Aurangabad **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** Plant Breeding & Genetics (PG)

Course Unit Code: MPB -124

Course Unit Title: Breeding for Biotic & Abiotic stress

Resistance

Credits allocated: 4 (4Theory+0Practical)**Level of Study :** PG

Mode of delivery, planned learning activities and teaching method: Lecture 3 hrs / weekly

Recommended Year /Semester: Plant Breeding & Genetics -Master of Science, Year 1/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form

Outcomes: On completion of the course, students are able to understand

1. Importance of plant breeding with special reference to biotic and abiotic stress resistance
2. Types and genetic mechanisms of resistance to biotic stresses
3. Phenotypic screening methods for major pests and diseases
4. Genetics of abiotic stress resistance

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

COURSE CONTENTS

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 defence responses to pathogen invasions – Biochemical and molecular mechanisms; Acquired and induced immunity and systemic acquired resistance (SAR); Host-pathogen interaction, gene-for-gene hypothesis, molecular evidence for its operation and exceptions; Concept of signal transduction and other host-defence mechanisms against viruses and bacteria.

UNIT II

Types and genetic mechanisms of resistance to biotic stresses – Horizontal and vertical resistance in crop plants. Quantitative resistance/Adult plant resistance and Slow rusting resistance - Classical and molecular breeding methods - Measuring plant resistance using plant fitness; Behavioural, physiological and insect gain studies.

UNIT III

Phenotypic screening methods for major pests and diseases; Recording of observations; Correlating the observations using marker data – Gene pyramiding methods and their implications.

Classification of abiotic stresses - Stress inducing factors – moisture stress/drought and water logging & submergence; Acidity, salinity/alkalinity/sodicity; High/low temperature, wind, etc. Stress due to soil factors and mineral toxicity; Physiological and Phenological responses; Emphasis of abiotic stresses in developing breeding methodologies.

UNIT IV

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; Utilizing MAS procedures for identifying resistant types in important crops like rice, sorghum, wheat, cotton etc; Breeding for resistance to stresses caused by toxicity, deficiency and pollutants/contaminants in soil, water and environment.

Exploitation of wild relatives as a source of resistance to biotic and abiotic factors in major field crops - Transgenics in management of biotic and abiotic stresses, use of toxins, protease inhibitors, lectins, chitinases and Bt for diseases and insect pest management – Achievements.

Suggested Readings/ Reference Books / Text Books

1. Blum A. 1988. Plant Breeding for Stress Environments. CRC Press.
2. Christiansen MN & Lewis CF. 1982. Breeding Plants for Less Favourable Environments. Wiley International.
3. Fritz RS & Simms EL. (Eds.). 1992. Plant Resistance to Herbivores and Pathogens: Ecology, Evolution and Genetics. The University of Chicago Press.
4. Li PH & Sakai A. 1987. Plant Cold Hardiness. Liss, New York
5. Luginill P. 1969. Developing Resistant Plants - The Ideal Method of Controlling Insects. USDA, ARS, Washington DC.
6. Maxwell FG & Jennings PR. (Eds.). 1980. Breeding Plants Resistant to Insects. John Wiley & Sons.
7. Painter RH. 1951. Insect Resistance in Crop Plants. MacMillan, New York.
8. Russel GE. 1978. Plant Breeding for Pest and Disease Resistance. Butterworths.
9. Sakai A & Larcher W. 1987. Frost Survival in Plants. Springer-Verlag.

Assessment Method

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4 Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
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1.	70	7
2.	80	8
3.	90	9
4.	100	10

10. Turener NC & Kramer PJ. 1980. Adaptation of Plants to Water and High Temperature Stress. John Wiley & Sons.
11. van der Plank JE. 1982. Host-Pathogen Interactions in Plant Disease. Academic Press.

SYLLABUS STRUCTURE SHEET

University: MGM University, Aurangabad **Faculty:** Basic& Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: PBL-125

Course Unit Title: Basic concept in Laboratory Technique (practical)

Credits allocated: 3+0 (0Theory+3Practical) **Level of Study:** PG

Mode of delivery, planned learning activities and teaching method: Practical 6 hrs weekly

PRACTICAL: List of Experiments

Phenotypic screening techniques for sucking pests and chewing pests–

1. Traits to be observed at plant and insect level-
2. Phenotypic screening techniques for nematodes and borers;
3. Ways of combating them; Breeding strategies-
4. **Weeds – ecological, environmental impacts on the crops;**
5. Breeding for herbicide resistance-
6. Evaluating the available populations like RIL, NIL etc. for pestresistance;
7. Use of standard MAS procedures-
8. Phenotypic screening methods for diseases caused by fungi and bacteria;
9. Symptoms and data recording; use of MAS procedures -
10. Screening forage crops for resistance to sewage water and tannery effluents;
11. Quality parameters evaluation -
12. Screening crops for drought and flood resistance;
13. factors to be considered and breeding strategies-
14. Screening varieties of major crops for acidity and alkalinity- their effects and breeding strategies;
15. Understanding the climatological parameters and predisposal of biotic and abiotic stress factors- ways of combating them.

Practical Assessment for 100 marks

Components(TW)	Record Book	Table Viva	Attendance	Total Marks
Internal Marks	10	10	20	40
External Assessment: Semester End Practical				60
Total Marks				100

- **Performance** - In ongoing academic semester practicals are conducted to analyze the students whether they are gaining Practical knowledge and they are doing their practical individually.
- **Record book** -In ongoing academic semester the role of Record Book is to develop their writing skills & they have the data of practicals in it.
- **Table Viva**- Table Viva is important to build student confidence. How much students are clearer about their practical Knowledge

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	14
2.	80	16
3.	90	18
4.	100	20

Internal Practical Exam: In ongoing academic semester the Internal Practical Exam are conducted to check their practical skills and techniques Usually in laboratory. They will be better placed to perform well in a practical exam if they can report their methodology and observations accurately

SYLLABUS STRUCTURE SHEET

University: MGM University, Aurangabad **Faculty:** Plant Breeding & Molecular Genetics
Institute: Institute of Biosciences and Tech. **Degree:** M.Sc. Plant Breeding & Molecular Genetics (PG)
Course Unit Code: PBL-126 **Course Unit Title:** Plant Breeding Molecular lab (Practical)
Credits allocated: 1+0 (0Theory+1Practical) **Level of Study:** PG
Mode of delivery, planned learning activities and teaching method: Practical 6 hrs weekly

PRACTICAL: List of Experiments

1. Identification of suitable areas/locations for seed production;
2. Ear-to-row method and nucleus seed production -
3. Main characteristics of released and notified varieties, hybrids and parentallines;
4. Identification of important weeds/objectionable weeds;
5. Determination of isolation distance and planting ratios in differentcrops;
6. Seed production techniques of varieties in differentcrops;
7. Hybrid seed production technology of importantcrops.

Practical Assessment for 50 marks

Components(TW)	Record Book	Table Viva	Attendance	Total Marks
Internal Marks	5	5	10	20
External Assessment: Semester End Practical				30
Total Marks				50

- **Performance** - In ongoing academic semester practicals are conducted to analyze the students whether they are gaining Practical knowledge and they are doing their practical individually.
- **Record book** -In ongoing academic semester the role of Record Book is to develop their writing skills & they have the data of practicals in it.
- **Table Viva**- Table Viva is important to build student confidence. How much students are clearer about their practical Knowledge
- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
--------	--------------------------	-------

1.	70	7
2.	80	8
3.	90	9
4.	100	10

- **Internal Practical Exam:** In ongoing academic semester the Internal Practical Exam are conducted to check their practical skills and techniques usually in laboratory. They will be better placed to perform well in a practical exam if they can report their methodology and observations accurately.

SYLLABUS STRUCTURE SHEET

MINI PROJECT

University: MGM University, Aurangabad
Institute: Institute of Biosciences and Tech.

Faculty: Basic & Applied Science
Degree: M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: PBL-127
Credits allocated: 0+2

Course Unit Title: Mini Project
Level of Study: PG

Mode of delivery planned learning activities and teaching method: Lecture 6 hrs / weekly

Recommended Year /Semester: Plant Breeding & Molecular Genetics

Year 1/ Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidates should pass in undergraduate Life Science.

Mode of delivery, planned learning activities and teaching method: Practical 3 hrs / weekly

Recommended Year /Semester: Food Technology, Year I/ Semester II

Course Outcomes:

1. Students will be able to practice acquired knowledge within the chosen area of technology for project development.
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

Ideas of project:

Defining project ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.

Literature survey:

A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.

Performance:

Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.

1. Implementation:

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2. Evaluation:

Clearly relates to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3. Project Log:

- a. The individual student's effort and commitment.
- b. The quality of the work produced by the individual student.
- c. The student's integration and co-operation with the rest of the group.
- d. The completeness of the logbook & time to time signature of guide

Objective: To elaborate the procedure for Guiding Student projects

Responsibility:

- All the Project Guide.
- All Semester B.Sc. students
- Project Heads

PROCEDURE

Sr.	Activities	Responsibility
1.	PG students are to decide on their team members for their semester project with their proposed project domain and title.	Project PG students, Head.
2.	Director shall allocate the Project Guide based on their area of expertise (not more than 3 batches to a Guide)	Director
3.	Ensuring that students have regular discussion meetings with their Project guides.	Project Guide, Project Head
4.	Synopsis pre preparation and submission	project head
4.	Verification of Student project log book.	Project Head and Project Guide.
5.	Approval of PPT: Abstract, Existing, Proposed system. 30% of proposed work. 80% of proposed work. 100% of proposed work.	Project Guide
6.	Preparation and submission of progress report during project	Students, Project Head.
7.	Preparing list for Redo students (Insufficient content, Plagiarism, poor presentation Genuine Absentees)	Project Heads
8.	Submission of hard copy of Project report	Project Head
9.	Evaluation of Project report	External Examiner
8.	Organizing final project viva-voce.	Project Heads
9.	Ensuring that If a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.	Project Head, Project Guide, Director
10.	Collecting copies of the approved project report after the successful completion of viva examinations.	Project Head.

Project Assessment: In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below. (Equal weightage of percentage to marks is given)

05	10	15	10	40
External Assessment:				60
Total Marks				100

Attendance – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below. (Equal weightage of percentage to marks is given)

Sr. No	Percentage of attendance	Marks
1.	70%	7
2.	80%	8
3.	100%	10

Mini Project External Assessment (Marks distribution):100

External Assessment: Semester End Project Examination						
Components	Project Report (10)	PowerPoint Presentation (10)	Viva Voce (10)	Innovativeness (20)	Individual Contribution (10)	Total (60)
Total marks						60

- **Ideas of project:**
Defining projects ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.
- **Literature survey:**
A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.
- **Performance:**
Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.
 - 1. Implementation:**
Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.
 - 2. Evaluation:**
Clearly relates solution to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.
 - 3. Project Log:**
 - a. The individual student's effort and commitment.
 - b. The quality of the work produced by the individual student.
 - c. The student's integration and co-operation with the rest of the group.
 - d. The completeness of the logbook & time to time signature of guide

SEMINAR

University: MGM University, Aurangabad	Faculty: Basic & Applied Science				
Institute: Institute of Biosciences and Tech.	Seminar Topic: Understanding of Subject	Degree: M.Sc. Plant Breeding & Molecular Genetics	Presentation: 05	Attendance: 05	Total Marks: 20
Course Unit Code: PBL-128	05	05	Course Unit Title: Seminar		
Credits allocated: 01	Test/Oral Assessment:			Level of Study: PG	30
Mode of delivery:	Total Marks				50

planned learning activities and teaching method: Lecture 3 hrs / weekly

Recommended Year /Semester: Plant Breeding & Molecular Genetics

Year 1/ Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidates should pass in undergraduate Life Science.

Outcomes:

- 1.The purpose of a seminar is to create an experience of working together.
- 2.One of the main objectives of conducting seminars is to avoid a passive experience everyone should have a way to contribute and communicate and also stage daring Improves.

Detail syllabus

- 1) The allotted faculty will notify about seminar conduction to the students of respective class.
- 2) The seminar topics will be listed by the students initially based on their topic of interest.
- 3) The seminar topics will be discussed with the faculty for finalizing the topic.
- 4) The finalized seminar topics will be displayed on the notice board with Director's approval.
- 5) The students will prepare the seminar topics; PPT and word file in allotted hours.
- 6) The final seminar presentation will be done by the students according t the exam date scheduled by the University,
- 7) Evaluation of the final seminar presentation and the word file will be done by the external examiner allotted by the University.

SEMINAR ASSESMENT (Marks distribution): 50

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below. (Equal weightage of percentage to marks is given)

Sr. No	Percentage of attendance	Marks
5.	70	2
6.	80	3
7.	90	4
8.	100	5

Seminar Topic	Understanding of Subject	Presentation	Attendance	Total Marks
10	10	10	10	40
External Assessment:				60
Total Marks				100

SYLLABUS STRUCTURE SHEET

OPEN ELECTIVE COURSE

University: MGM University, Aurangabad

Institute: Institute of Biosciences and Tech.

Faculty: Basic & Applied Science

Degree: M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: PBL-129

Credits allocated: 0+1

Course Unit Title: Open Elective Course

Level of Study: PG

Mode of delivery planned learning activities and teaching method: Lecture 3 hrs / weekly

Recommended Year /Semester: Plant Breeding & Molecular Genetics II SEM/ I year

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidates should pass in undergraduate Life Science.

- It is mandatory for undergraduate & post graduate students to undertake open elective courses for
- concern credits before the completion of the degree.
- Students have the option of choosing any open Elective courses under the category of mandatory elective courses.
- A student is not eligible for more than one open Elective course under the category of mandatory courses.
- For UG and PG programs the Open Electives are offered within the regular class hours.

- These courses generally earn concern credits consisting of 8 weeks-12 weeks during the completion of semester.
- Students can view the complete details of the courses offered Elective courses in their course layout.
- Till a student finishes OEC under the mandatory course category, he/she is eligible to apply for other open elective courses.
- Evaluation pattern is the discretion of the faculty concerned for UG & PG courses will be with only end semester examinations
- Examinations are conducted by the departments concerned and the results are indicated only in Grades in the marks card.
- Minimum pass percentage is 40% for courses under the mandatory category. Grades are awarded only if the student passes.
- These courses are conducted after or before the regular class hours and the courses offered are different in Odd and Even semesters.
- Students are advised to finalize their choice of programs in consultation with their OEC coordinator.
- Minimum prescribed attendance for these courses is 85%. **Medical and co-curricular claim will be considered only if the student put in 75% physical attendance or the classes.**
- Attendance claim shall be submitted to OEC coordinator within 07 days after availing the leave.
- Students who fail to secure the minimum pass marks or required minimum attendance or who discontinue in between the course are required to register afresh. Re-registration is permitted only in the subsequent semester which may be for the same course or any other courses from the choices available during the particular semester.
- He / She submit course syllabus weekly report on the basis of that OEC co-ordinator conduct their continuous assessment.
- A student is not eligible to graduate without completing OEC mandatory course.
- OEC offered by other departments like Performing Arts, Industrial Automation, Industry 4.0, Vastushashtra, Sketching, Hotel Management, Film Making, Python programming, Theatre and Music etc.
- Each course admits only 40 students on a first-come-first-served basis. Courses which do not get minimum required applications may not be conducted.

The Department/Centre/Office of the activity/event concerned will set the relevant parameters to measure the content of each given criterion depending on the need and application of the particular activity/event and will assess the performance of every student objectively.

Assessment of OEC (1 Credit: 50Marks)

Internal Evaluation

Internal Assessment	10Marks
Weekly Report Submission	10Marks

- Student should register and submit joining certificate/ registered authentic document to OEC coordinator.
- Students should submit weekly report on the basis of course.
- OEC coordinator will conduct their continuous assessment for all activities during semester.

External Evaluation

Certificate Submission	30Marks
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Note: If the student unable to submit the OEC Certificate, for them there will be conduction of department (internal) examination, on the basis of open elective course syllabus submitted / selected by students.

MGM UNIVERSITY, AURANGABAD
INSTITUTE OF BIOSCIENCES AND TECHNOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Basic & Applied Science
Post Graduate (PG) programme
Plant Breeding & Molecular Genetics
w. e. f. Academic Year 2021-22
M.Sc. Plant Breeding & Molecular Genetics

SEMESTER-III
CURRICULUM

Semester III																				
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing						Credit		
						Internal			External			Total	Internal			External			Total	
						L	T	P	CA	MSE	TW		ESE	PR	CA	MSE	TW			ESE
(Mandatory)																				
MPB-231	Heterosis Breeding	Theory	4			20	20		60		100	-	-	-	24	-	40	4		
MPB-232	Advanced Biometrical and Quantitative Genetics	Theory	4			20	20		60		100	-	-	-	24	-	40	4		
PBL-233	Crop Production Technology (Practical)	Practical			8			40	60	100	-	-	16		24	40	4			
PBL-234	Major Project	Practical			8			80	120	200	-	-	32		48	80	4			
PBL-235	Seminar	Practical			2			40	60	100	-	-	16		24	40	2			
PBL-236	Blended Course	Practical			2			40	60	100	-	-	16		24	40	2			
	Total		8		20	40	40	200	120	300	700	0	0	80	48	120	280	20		

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work

SYLLABUS STRUCTURE SHEET HETEROSIS BREEDING

University: MGM University, Aurangabad **Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech. **Degree:** M. Sc. Plant Breeding & Genetics (PG)
Course Unit Code: MPB-231 **Course Unit Title:** Heterosis Breeding

Credits allocated: 4 **Level of Study:** PG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs / weekly

Recommended Year /Semester : Plant Breeding & Molecular genetics-Master of Science, Year 2/ Semester III

Prerequisites for registration :Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form.

Candidate should pass in Under Graduate Life Sciences.

Learning Outcomes:On completion of the course, students are able to understand

1. Historical aspect of heterosis - Nomenclature and definitions of heterosis
2. Prediction of heterosis from various crosses
3. Types of male sterility and use in heterosis breeding
4. Fixation of heterosis

Objective: To provide understanding about mechanisms of heterosis and its exploitation for yield improvement through conventional and biotechnological approaches.

COURSE CONTENTS

THEORY

UNIT I

Historical aspect of heterosis - Nomenclature and definitions of heterosis - Heterosis in natural population and inbred population; Evolutionary aspects - Genetic consequences of selfing and crossing in self-and cross-pollinated and asexually propagated crops. Pre Mendelian and Post-Mendelian ideas - Genetic theories of heterosis –Physiological, Biochemical and molecular factors underlining heterosis; theories and their estimation; - Evolutionary concepts of heterosis.

UNIT II

Prediction of heterosis from various crosses- Inbreeding depression, frequency of inbreeding and residual heterosis in F₂ and segregating populations, importance of inbreeding in exploitation of heterosis – case studies. - Relationship between genetic distance and expression of heterosis – case studies; Divergence and Genetic Distance analyses-morphological and molecular genetic distance in predicting heterosis, Development of heterotic pools in germplasm/genetic stocks and inbreds, their improvement for increasing heterosis.

UNIT III

Types of male sterility and use in heterosis breeding; Maintenance, transfer and restoration of different types of male sterility; Use of self-incompatibility in development of hybrids; Hybrid seed production system: 3-line, 2-line and 1-line system; Development of inbreds and parental lines-A, B and R lines – functional male sterility; Commercial exploitation of heterosis- maintenance breeding of parental lines in hybrids.

UNIT IV

Fixation of heterosis in self, cross and often cross pollinated crops, asexually/clonally propagated crops; Male sterile line creation and diversification in self pollinated, cross pollinated and asexually propagated crops; problems and prospects; Apomixis in fixing heterosis-concept of single line hybrid. Organellar heterosis and complementation - Creation of male sterility through genetic engineering and its exploitation in heterosis. Heterosis breeding in wheat, rice, cotton, maize, pearl millet, sorghum and oilseed crops.

SUGGESTED READINGS/ REFERENCE BOOKS/ TEXT BOOKS

1. Proceedings of Genetics and Exploitation of Heterosis in Crops – An International Symposium CIMMYT, 1998.
2. Akin E. 1979. The Geometry of Population Genetics. Springer-Verlag.
3. Ben Hiu Lin. 1998. Statistical Genomics – Linkage, Mapping and QTL Analysis. CRC Press.
4. De Joung G. 1988. Population Genetics and Evolution. Springer-Verlag.
5. Hartl DL. 2000. A Primer of Population Genetics. 3 rd Ed. Sinauer Assoc.
6. Mettler LE & Gregg TG. 1969. Population Genetics and Evolution. Prentice-Hall.
7. Montgomery DC. 2001. Design and Analysis of Experiments. 5 th Ed., Wiley & Sons.
8. Richards AJ. 1986. Plant Breeding Systems. George Allen & Unwin.
9. Srivastava S & Tyagi R. 1997. Selected Problems in Genetics. Vols. I, II. Anmol Publ.

Assessment Method

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4 Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

SYLLABUS STRUCTURE SHEET

ADVANCED BIOMETRICAL AND QUANTITATIVE GENETICS

University: MGM University, Aurangabad

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Tech **Degree:** M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: MPB-232 **Course Unit Title:** Advanced Biometrical & Quantitative Genetics

Credits allocated: 4

Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Lecture 4hrs / weekly

Recommended Year /Semester: Plant Breeding & Molecular Genetics-Master of Science, Year 2/ Semester III

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form

Candidate should pass in Under Graduate Life Sciences.

Learning Outcomes: On completion of the course, students are able to understand

1. Basic principles of Biometrical Genetics
2. Models in stability analysis
3. Additive and multiplicative model
4. Marker Assisted Selection (MAS) and their significance in plant breeding.

Objective: To impart theoretical knowledge and computation methods for non allelic interactions, mating designs and component analysis and their significance in plant breeding.

COURSE CONTENTS

THEORY

UNIT I

Basic principles of Biometrical Genetics; Selection of parents; Advanced biometrical models for combining ability analysis; Simultaneous selection models; Use of Multiple regression analysis in selection of genotypes; Designs and Systems; Selection of stable genotypes.

UNIT II

Models in stability analysis - Pattern analysis - Additive Main Effect and Multiplicative Interaction (AMMI) analysis and other related models; Principal Component Analysis.

UNIT III

Additive and multiplicative model - Shifted multiplicative model; Analysis and selection of genotypes; Methods and steps to select the best model - Biplots and mapping genotypes.

Genetic architecture of quantitative traits; Conventional analyses to detect gene actions - Partitioning of phenotypic/genotypic variance – Construction of saturated linkage maps, concept of framework map development; QTL mapping- Strategies for QTL mapping - desired populations, statistical methods;

UNIT IV

Marker Assisted Selection (MAS) - Approaches to apply MAS in Plant breeding - selection based on markers - simultaneous selection based on marker and phenotype - Factors influencing MAS; Heritability of the trait, proportion of genetic variance, linkage disequilibrium between markers and traits and selection methods.

SUGGESTED READINGS/ REFERENCE BOOKS/ TEXT BOOKS

1. Bos I & P Caligari. 1995. Selection Methods in Plant Breeding. Chapman & Hall.
2. Falconer DS & Mackay J. 1996. Introduction to Quantitative Genetics. Longman.
3. Mather K & Jinks L. 1983. Introduction to Biometrical Genetics. Chapman & Hall.
4. Nadarajan N & Gunasekaran M. 2005. Quantitative Genetics and Biometrical Techniques in Plant Breeding. Kalyani.
5. Singh P & Narayanan SS. 1993. Biometrical Techniques in Plant Breeding. Kalyani.
6. Singh RK & Choudhary BD. 1987. Biometrical Methods in Quantitative Genetics. Kalyani.
7. Weir DS. 1990. Genetic Data Analysis. Methods for Discrete Population Genetic Data. Sinauer Associates.
8. Wricke G & Weber WE. 1986. Quantitative Genetics and Selection in Plant Breeding. Walter de Gruyter.

Assessment Method

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100			
Internal	MSE	CA	Total Marks

Assessment	(Unit test)	Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4 Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

SYLLABUS STRUCTURE SHEET
CROP PRODUCTION AND TECHNOLOGY

University: MGM University, Aurangabad

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Tech **Degree :** M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: PBL-233

Course Unit Title: Crop Production and Technology

Credits allocated: 4

Level of Study : PG

1. Crop Production technology and Practices of Black Gram.
2. Crop Production technology and Practices of Green Gram.
3. Crop Production technology and Practices of Cotton.
4. Crop Production technology and Practices of Chickpea.
5. Crop Production technology and Practices of Soyabean.
6. Crop Production technology and Practices of Red Gram.
7. Crop Production technology and Practices of Bajra.
8. Crop Production technology and Practices of Rice.
9. Crop Production technology and Practices of Wheat.
10. Crop Production technology and Practices of Maize.
11. To study the top Dressing and Foliar feeding of Nutrient.
12. To study the yield contributing character and yield estimation of Kharif Season Crop.
13. To study the yield contributing character and yield estimation of Rabi Season Crop.
14. Effect of Seed size on Germination and seedling Vigor.
15. To study sowing method of Wheat, Soyabean, Pigeon Pea, Green Gram, Maize, Groundnut and Cotton.
16. Study of Important Agronomic Experiment on Rabi Crops at Experimental Field.
17. Visit to Industry/Field of Related Crops.

SYLLABUS STUCTURE SHEET
MAJOR PROJECT

University: MGM University, Aurangabad
Institute: Institute of Biosciences and Tech.

Faculty: Basic & Applied Science
Degree: M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: PBL-234
Credits allocated: 0+4

Course Unit Title: Major Project
Level of Study: PG

Major Project External Assessment (Marks distribution):200

External Assessment: Semester End Project Examination						
Components	Project Report (20)	PowerPoint Presentation (20)	Viva Voce (20)	Innovativeness (40)	Individual Contribution (20)	Total (120)
Total marks						200

- **Ideas of project:**

Defining projects ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.

- **Literature survey:**

A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.

- **Performance:**

Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.

1. Implementation:

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2. Evaluation:

Clearly relates solution to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3. Project Log:

- a. The individual student's effort and commitment.
- b. The quality of the work produced by the individual student.
- c. The student's integration and co-operation with the rest of the group.
- d. The completeness of the logbook & time to time signature of guide

SYLLABUS STRUCTURE SHEET

SEMINAR

University: MGM University, Aurangabad
Institute: Institute of Biosciences and Tech.

Faculty: Basic & Applied Science
Degree: M.Sc. M.Sc. Plant Breeding & Molecular Genetics

Course Unit Code: PBL-235

Course Unit Title: Seminar

Credits allocated: 0+2

Level of Study: PG

Mode of delivery planned learning activities and teaching method: Lecture 3 hrs / weekly

Recommended Year /Semester M.Sc. Plant Breeding &Molecular Genetics Year 2/ Semester III

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidates should pass in undergraduate Life Science.

Outcomes:

1. The purpose of a seminar is to create an experience of working together.
2. One of the main objectives of conducting seminars is to avoid a passive experience everyone should have a way to contribute and communicate and also stage daring Improves.

SEMINAR

- 8) The allotted faculty will notify about seminar conduction to the students of respective class.
- 9) The seminar topics will be listed by the students initially based on their topic of interest.
- 10) The seminar topics will be discussed with the faculty for finalizing the topic.
- 11) The finalized seminar topics will be displayed on the notice board with Director's approval.
- 12) The students will prepare the seminar topics; PPT and word file in allotted hours.
- 13) The final seminar presentation will be done by the students according t the exam date scheduled by the University,
- 14) Evaluation of the final seminar presentation and the word file will be done by the external examiner allotted by the University.

SEMINAR ASSESMENT (Marks distribution): 100

Seminar Topic	Understanding of Subject	Presentation	Attendance	Total Marks
10	10	10	10	40
External Assessment:				60
Total Marks				100

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below. (Equal weightage of percentage to marks is given)

Sr. No	Percentage of attendance	Marks
9.	70	7
10.	80	8
11.	90	9
12.	100	10

SYLLABUS STRUCTURE SHEET BLENDED COURSE

University: MGM University, Aurangabad
Institute: Institute of Biosciences and Tech.

Faculty: Basic & Applied Science
Degree: M.Sc. Plant Breeding & Molecular Genetics)

Course Unit Code: PBL-236
Credits allocated: 0+2

Course Unit Title: Blended Course
Level of Study: PG

SOP for Blended Courses (PG I, II III & IV semester)

- It is mandatory for post graduate students to undertake blended courses for concern credits before the completion of the degree.
- Students have the option of choosing any blended courses under the category of mandatory elective courses.
- Students are advised to finalize their choice of programs in consultation with their Blended course coordinator.
- The course facilitator/mentor will conduct the whole course in consultation with Blended course coordinator.
- For PG programs the blended are offered within the regular class hours.
- These courses generally earn concern credits consisting of 1 Credit- 4 week 2 Credit-8 weeks 3-4 Credit -12 weeks during the completion of semester.
- Students can view the complete details of the courses offered blended courses in their course layout.
- Evaluation pattern is the discretion of the faculty concerned for PG courses will be with only end semester examinations
- Examinations are conducted by the departments concerned and the results are indicated only in Grades in the marks card.
- Minimum pass percentage is 40% for courses under the mandatory category. Grades are awarded only if the student passes.
- These courses are conducted after or before the regular class hours and the courses offered are different in Odd and Even semesters.
- Minimum prescribed attendance for these courses is 85%. Medical and co-curricular claim will be considered only if the student put in 75% physical attendance or the classes.
- Attendance claim shall be submitted to blended course coordinator within 07 days after availing the leave.
- Students who fail to secure the minimum pass marks or required minimum attendance or who discontinue in between the course are required to register afresh. Re-registration is permitted only in the subsequent semester which may be for the same course or any other courses from the choices available during the particular semester.
- He / She submit course syllabus weekly report on the basis of that blended course co-ordinator conduct their continuous assessment.
- A student is not eligible to graduate without completing OEC mandatory course.
- The course platform for registration are SWAYAM NPTEL, Agmooc and Coursera.

The Department/Centre/Office of the activity/event concerned will set the relevant parameters to measure the content of each given criterion depending on the need and application of the particular activity/event and will assess the performance of every student objectively.

Assessment of Blended Course (2 Credits: 100Marks)

Internal Evaluation

Internal Assessment	20 Marks
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Weekly Report Submission	20 Marks

- Student should register and submit joining certificate/ registered authentic document to OEC coordinator.
- Students should submit weekly report on the basis of course.
- OEC coordinator will conduct their continuous assessment for all activities during semester.

External Evaluation

Viva	20 Marks
Certificate Submission	40 Marks

MGM UNIVERSITY, AURANGABAD
INSTITUTE OF BIOSCIENCES AND TECHNOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Basic & Applied Science
Post Graduate (PG) programme
Plant Breeding & Molecular Genetics
w. e. f. Academic Year 2021-22
M.Sc. Plant Breeding & Molecular Genetics

SEMESTER-IV
CURRICULUM

Semester IV																				
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing						Credit		
						Internal			External			Total	Internal			External			Total	
						L	T	P	CA	MSE	TW		ESE	PR	CA	MSE	TW			ESE
(Mandatory)																				
MPB-241	Ethics/ Biosafety/ IPR	Theory	4			20	20		60		100	-	-	-	24	-	40	4		
PBL-242	Big Idea	Practical			20			80		120	200	-	-	32		48	80	10		
PBL-243	Blended Course	Practical			20			40		100	100	-	-	16		24	40	2		
	Total		4		22	20	20	120	60	180	400	0	0	48	24	72	160	16		

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work

SYLLABUS STRUCTURE SHEET

ETHICS/ BIOSAFETY/ IPR

University: MGM University, Aurangabad
Institute: Institute of Biosciences and Tech.
Course Unit Code: MPB-241
Credits allocated: 4+0

Faculty: Basic & Applied Science
Degree: M.Sc. Plant Breeding & Molecular Genetics (PG)
Course Unit Title: Ethics/ Biosafety/ IPR
Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs weekly

Recommended Year /Semester: Plant Breeding & Molecular Genetics Master's of Science, Year 2/ IV Semester

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form
Candidate should pass in Under Graduate Life Sciences.

Outcomes: On completion of the course, students are able to understand

Explain the introduction, guidelines patent rights and systems

1. Biosafety: Introduction – biosafety issues in biotechnology - historical background.
2. Biosafety Guidelines
3. Intellectual Property Rights: Introduction to IPR, Types of IP
4. Patents And Patent Laws: Objectives of the patent system

Objective: To discuss about various aspects of biosafety regulations, IPR and bioethic concerns arising from the commercialization of biotech products.

COURSE CONTENTS

THEORY

UNIT- I

Biosafety:

Introduction – biosafety issues in biotechnology - historical background. Biological Safety Cabinets, Primary Containment for Biohazards. Biosafety Levels - Levels of Specific Microorganisms, Infectious Agents and Infected Animals.

UNIT- II

Biosafety Guidelines:

Guidelines and regulations (National and International including Cartagena Protocol) – operation of biosafety guidelines and regulations of Government of India; Definition of GMOs & LMOs. Roles of Institutional Biosafety Committee, RCGM, GEAC etc.

for GMO applications in food and agriculture. Environmental release of =GMOs - Risk - Analysis, Assessment, management and communication.

UNIT- III

Intellectual Property Rights:

Introduction to IPR, Types of IP - Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge and Geographical Indications. Importance of IPR – patentable and non patentables, patenting life, legal protection of Biotechnological inventions. Agreements and Treaties - History of GATT & TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments. IPR and WTO regime - Consumer protection and plant genetic resources.

UNIT- IV

Patents And Patent Laws:

Objectives of the patent system - Basic, principles and general requirements of patent law. Biotechnological inventions and patent law - Legal development - Patentable subjects and protection in Biotechnology. Patent Filing Procedures - National & PCT filing procedure, Time frame and cost, Status of the patent applications, Precautions while patenting, disclosure/ nondisclosure, financial assistance for patenting, introduction to existing schemes. Patent licensing and agreement. Patent infringement - meaning, scope, litigation, case studies.

UNIT- V

Bioethics:

Introduction to ethics and bioethics, framework for ethical decision making. Ethical, legal and socioeconomic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research. Ethical implications of GM crops, GMO's, human genome project, human cloning, designer babies, biopiracy and biowarfare. Eugenics and its possible approaches. Animal right activities -Blue cross in India-society for prevention of cruelty against animals. Ethical limits of Animal use. Green peace - Human Rights and Responsibilities.

Recommended readings:

1. Beier F.K, Crespi R.S and Straus T. Biotechnology and Patent protection, Oxford and IBH Publishing Co. New Delhi.
2. Jeffrey M. Gimble, Academia to Biotechnology, Elsevier Academic Press.
3. Rajmohan Joshi (Ed.). 2006. Biosafety and Bioethics. Isha Books, Delhi.
4. Sasson A, Biotechnologies and Development, UNESCO Publications.
5. Senthil Kumar Sadasivam and Mohammed Jaabir M. S. (2008). IPR, Biosafety and Biotechnology Management, Jasen Publications, India.
6. Singh BD. 2007. Biotechnology: Expanding Horizon. Kalyani.
7. <http://patentoffice.nic.in>, 8. www.wipo.org 9. www.dbtindia.nic.in 10. www.dbtbiosafety.nic.in

Assessment Method

Course Evaluation /Weightage: The relative weightage to the various examinations conducted, Unit test, Quiz, Home Assignment, Seminar and record maintained during a semester shall be as under both for Bachelors degree programmers.

Theory Assessment (Marks distribution): 100				
Internal Assessment	MSE (Unit test)	CA		Total Marks
		Attendance record	Home Assignment	
	20	10	10	40
External Assessment: Semester End Theory Examination				60
Total Marks				100

Internal Assessment (Marks conduction): 40

I. Unit Test Conduction:

In ongoing academic semester unit test are conducted to analyze students whether they are gaining theoretical knowledge, and also to keep them engaged in concerned subject continuously so as to better understand the subject develop interest in it.

No. of unit test	Total Marks
1	20

- Short Notes (any 3) out of 4 Marks-15
- 5 MCQs Marks-5

II. Home Assignment Conduction:

In ongoing academic semester home assignment are conducted to develop further in subject, more interest in subject and also to improve students writing skills necessary for scientific communication.

No. of Home Assignment	Total Marks
2	10

- **Attendance** – In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practical, lectures, seminars). The criteria of attendance are given below.

Sr. No	Percentage of attendance	Marks
1.	70	7
2.	80	8
3.	90	9
4.	100	10

SYLLABUS STRUCTURE SHEET

BIG IDEA

University: MGM University, Aurangabad

Institute: Institute of Biosciences and Technology

Course Unit Code: PBL-242

Credits allocated: 0+10

Faculty: Basic & Applied Science

Degree: M.Sc. Plant Breeding & Molecular Genetics (PG)

Course Unit Title: Big Idea

Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs weekly

Recommended Year /Semester: Plant Breeding & Molecular Genetics Master's of Science, Year 2/ IV Semester

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the Principal. The approved courses must be mentioned in the roster form
Candidate should pass in Under Graduate Life Sciences.

Objective: To elaborate the procedure for Guiding Student projects

- **Ideas of project:**

Defining projects ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.

- **Literature survey:**

A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.

- **Performance:**

Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.

- 1. Implementation:**

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2.Evaluation:

Clearly relates solution to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3. Project Log:

- a. The individual student's effort and commitment.
- b. The quality of the work produced by the individual student.
- c. The student's integration and co-operation with the rest of the group.
- d. The completeness of the logbook& time to time signature of guide

Project Assessment (200 Marks)

Idea of Project	Understanding of Subject	Literature survey	Attendance	Total Marks
20	20	20	20	80
External Assessment				120
Total Marks				200

Ideas of project:

Defining projects ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.

Literature survey:

A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.

Performance:

Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.

1. Implementation:

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2. Evaluation:

Clearly relates solution to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3. Project Log:

- a. The individual student's effort and commitment.
- b. The quality of the work produced by the individual student.
- c. The student's integration and co-operation with the rest of the group.
- d. The completeness of the logbook & time to time signature of guide

- **Attendance:**

In ongoing semester attendance are important for students. They are expected to do their project in the semester that is timetabled. The criteria of attendance are given below.

Sr.No.	Percentage of attendance	Marks
1.	70	14
2.	80	16
3.	90	18
4.	100	20

Project External Assessment (Marks distribution):120

External Assessment: Semester End Project Examination						
Components	Project Report	PowerPoint Presentation	Viva Voce	Innovativeness	Individual Contribution	Total
	20	20	20	40	20	120
Total marks						200

**SYLLABUS STRUCTURE SHEET
BLENDED COURSE**

University: MGM University, Aurangabad	Faculty: Basic & Applied Science
Institute: Institute of Biosciences and Tech.	Degree: M.Sc. Plant Breeding & Molecular Genetics (PG)
Course Unit Code: PBL-243	Course Unit Title: Blended Course
Credits allocated: 0+2	Level of Study: PG

SOP for Blended Courses (PG I, II III & IV semester)

- It is mandatory for post graduate students to undertake blended courses for concern credits before the completion of the degree.
- Students have the option of choosing any blended courses under the category of mandatory elective courses.
- Students are advised to finalize their choice of programs in consultation with their Blended course coordinator.
- The course facilitator/mentor will conduct the whole course in consultation with Blended course coordinator.
- For PG programs the blended are offered within the regular class hours.
- These courses generally earn concern credits consisting of 1 Credit- 4 week 2 Credit-8 weeks 3-4 Credit -12 weeks during the completion of semester.
- Students can view the complete details of the courses offered blended courses in their course layout.
- Evaluation pattern is the discretion of the faculty concerned for PG courses will be with only end semester examinations
- Examinations are conducted by the departments concerned and the results are indicated only in Grades in the marks card.
- Minimum pass percentage is 40% for courses under the mandatory category. Grades are awarded only if the student passes.
- These courses are conducted after or before the regular class hours and the courses offered are different in Odd and Even semesters.
- Minimum prescribed attendance for these courses is 85%. Medical and co-curricular claim will be considered only if the student put in 75% physical attendance or the classes.
- Attendance claim shall be submitted to blended course coordinator within 07 days after availing the leave.
- Students who fail to secure the minimum pass marks or required minimum attendance or who discontinue in between the course are required to register afresh. Re-registration is permitted only in the subsequent semester which may be for the same course or any other courses from the choices available during the particular semester.
- He / She submit course syllabus weekly report on the basis of that blended course co-ordinator conduct their continuous assessment.
- A student is not eligible to graduate without completing OEC mandatory course.
- The course platform for registration are SWAYAM NPTEL, Agmooc and Coursera.

The Department/Centre/Office of the activity/event concerned will set the relevant parameters to measure the content of each given criterion depending on the need and application of the particular activity/event and will assess the performance of every student objectively.

Assessment of Blended Course (2 Credit: 100Marks)

Internal Evaluation

Internal Assessment	20Marks
Weekly Report Submission	20Marks

- Student should register and submit joining certificate/ registered authentic document to OEC coordinator.
- Students should submit weekly report on the basis of course.
- OEC coordinator will conduct their continuous assessment for all activities during semester.

External Evaluation

Certificate Submission	60Marks
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Note: If the student unable to submit the OEC Certificate, for them there will be conduction of department (internal) examination, on the basis of open elective course syllabus submitted / selected by students.

