MGM UNIVERSITY, CHH. SAMBHAJINAGAR

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Basic and Applied Sciences

Post Graduate (PG) progrmme

Plant Breeding and Molecular Genetics - CURRICULUM

w. e. f. Academic Year 2023-24

M.Sc. Plant Breeding and Molecular Genetics

CURRICULUM

Prepared By
Dr. G. W. Narkhede

Submitted By
Dr. G. W. Narkhede

Approved By
Board of Studies

Illustrative Credit distribution structure for Two Years/ One Year PG									
M.Sc. Post Graduation Programme (M.Sc. Plant Breeding and Molecular Genetics)									
			Major			**OJT/ FP**		**Cum. Cr.**	**Degree**
Year	**Level**	**Sem.**	**Mandatory**	**Electives**	**RM**		**RP**		
I	**6**	**I**	14 (4*2 + 2*3)	4	4			22	
		II	14 (4*3 +2)	4		4		22	**PG Diploma (after 3 Yr Degree)**
Cum. Cr. For PG Diploma			**28**	**8**	**4**	**4**	**-**	**44**	
Exit option: PG Diploma (44 Credits) after Three Year UG Degree									
II	**6.5**	**III**	12 (3*4)	4			4	20	
		IV	10 (1*10)	4			8	22	
Cum. Cr. for 1 Yr PG Degree			**22**	**8**	**4**		**12**	**42**	**PG Degree After 3-Yr UG Or**
Cum. Cr. for 2 Yr PG Degree			**50**	**16**	**4**	**4**	**12**	**86**	**PG Degree after 4-Yr UG**
2 Years-4 Sem. PG Degree (86-credits) after Three Year UG Degree or 1 Year - 2 Sem PG Degree (42- credits) after Four Year UG Degree									

Appendix-2023																		
PROGRAMME: M.Sc. Plant Breeding and Molecular Genetics																		
Semester I																		
Level	**Course Code**	**Course Title**	**Type**	**Course Type**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
								Internal				**External**				**External**		
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6.0	**MGMML101**	**Principles of Genetics and Plant Breeding**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	0	20
	MGMML102	**Principles of Cytogenetics**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	0	40
	MGMML103	**Molecular Cell Biology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	0	40
	MGMML104	**Biochemistry**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	0	20
	MGMML105	**Plant Physiology and Development**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	0	20
	MGMMJ106	**Mini Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-		8	20
	MGMEP107 MGMEP108	**1. Breeding Farming 2. Cytogenetics Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-		8	20
	MGMEP109 MGMEP110	**1. Breeding Lab 2. Basic Concepts in Laboratory Techniques**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-		8	20
	-	**Research Methodology**	**Theory**	**RM**	4	-	4	20	20	20	-	-	-	100	-	16	0	40
		Total (L- P) Hrs / week = 28			**16**	**12**	**22**	**90**	**90**	**90**	**90**	**140**	**60**	**600**		**72**	**16**	**240**

Semester II (M.Sc. PBMG)																		
Level	**Course Code**	**Course Title**	**Type**	**Course Type**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6.0	**MGMML111**	**Principles of Quantitative Genetics**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	0	40
	MGMML112	**Recombinant DNA Technology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	0	40
	MGMML113	**Maintenance Breeding, Concept of Variety Release & Seed Production**	**Theory**	**Major Mandatory**	3	-	3	10	10	10	-	20		50		8	0	20
	MGMML114	**Breeding for Biotic & Abiotic Stress Resistance**	**Theory**	**Major Mandatory**	3	-	3	10	10	10	-	20	-	50	-	8	0	20
	MGMEP115 MGMEP116	**1. Maintenance Breeding Lab 2. Plant Breeding Molecular Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	8	0	20
	MGMEP117 MGMEP118	**1. Quantitative Genetics Lab 2. Breeding for Biotic and Abiotic Stress Resistance Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-		8	20
	MGMMJ119	**Micro Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-		8	20
	MGFPJ120	**Field Project**	**FP**	**FP**	-	8	4	-	-	-	60	-	40	100	-	-	16	40
		Total (L- P) Hrs / week = 32			**12**	**20**	**22**	**60**	**60**	**60**	**150**	**120**	**100**	**550**		**56**	**32**	**220**

Level 6.0 Award of PG Diploma (44 Credits) after Three Year UG Degree

Semester III (M.Sc. PBMG)																			
Level	**Course code***	**Course Title**	**Type**	**Category**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
								Internal				**External**		**Total**		**External**		
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**		**Internal**	**ESE**	**PR**	**Total**
6.5	**MGMML201**	**Breeding Designer Crops**	**Theory**	**Major Mandatory**	4	-	4	20	20	20	-	40	0	100	-	16	0	40
	MGMML202	**Breeding for Cereals and Forage Crops**	**Theory**	**Major Mandatory**	4	-	4	20	20	20	-	40	0	100	-	16	0	40
	MGMML203	**Heterosis and Mutation Breeding**	**Theory**	**Major Mandatory**	4	-	4	20	20	20	-	40	-	100	-	16	0	40
	MGMEP204 MGMEP205	**1. Breeding Designer Crops 2. Crop Production Technology**	**Practical**	**Major Elective**	-	8	4	-	-	-	60	0	40	100	-	0	16	40
	MGRPJ206	**1. Major Project**	**RP**	**RP**	-	8	4	-	-	-	60	0	40	100	-	0	16	40
		Total (L- P) Hrs / week = 28			**12**	**16**	**20**	**60**	**60**	**60**	**120**	**120**	**80**	**500**	**-**	**48**	**32**	**200**

Semester IV (M.Sc. PBMG)																		
Level	**Course code***	**Course Title**	**Type**	**Category**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
								Internal				**External**				**External**		
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6.5	**MGMEL207** **MGMEL208**	**1. Ethics / Biosafety / IPR** **2. Molecular Plant Breeding**	**Theory**	**Major Elective**	4	-	4	20	20	20	-	40	-	100	-	16	-	40
	MGJTI209	**On Job Training**	**OJT**	**Major Mandatory**	-	20	10	-	-	-	200	-	50	250	-	-	20	50
	MGRPJ210	**Research Project**	**RP**	**RP**	-	16	8	-	-	-	150	-	50	200	-	-	20	50
		Total (L- P) Hrs / week = 40			**4**	**36**	**22**	**20**	**20**	**20**	**350**	**40**	**100**	**550**	**-**	**16**	**40**	**140**

Level 6.5 Award of PG Degree after Three Years UG Degree with 86 credits OR Four Years UG Degree with 42 credits

MGM UNIVERSITY, CHH. SAMBHAJINAGAR

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Basic and Applied Sciences

Post Graduate (PG) progrmme

Plant Breeding and Molecular Genetics - CURRICULUM

w. e. f. Academic Year 2023-24

M.Sc. Plant Breeding and Molecular Genetics

CURRICULUM: Semester I

Appendix-2023																			
PROGRAMME: M.Sc. Plant Breeding and Molecular Genetics																			
Semester I																			
Level	**Course Code**	**Course Title**	**Type**	**Course Type**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
								Internal				**External**				**External**		
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6.0	**MGMML101**	**Principles of Genetics and Plant Breeding**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	0	20
	MGMML102	**Principles of Cytogenetics**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	0	40
	MGMML103	**Molecular Cell Biology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	0	40
	MGMML104	**Biochemistry**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	0	20
	MGMML105	**Plant Physiology and Development**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	0	20
	MGMMJ106	**Mini Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-		8	20
	MGMEP107 MGMEP108	**1. Breeding Farming 2. Cytogenetics Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-		8	20
	MGMEP109 MGMEP110	**1. Breeding Lab 2. Basic Concepts in Laboratory Techniques**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-		8	20
	-	**Research Methodology**	**Theory**	**RM**	4	-	4	20	20	20	-	-	-	100	-	16	0	40
		Total (L- P) Hrs / week = 28			**16**	**12**	**22**	**90**	**90**	**90**	**90**	**140**	**60**	**600**		**72**	**16**	**240**

SYLLABUS STRUCTURE SHEET
University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

PRINCIPLES OF GENETICS AND PLANT BREEDING

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMML101

Course Title: Principles of Genetics and Plant Breeding

Credits: 2 + 0 (2 Theory + 0 Practicals)

Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Lecture 2 hrs / weekly

Recommended Year /Semester: Plant Breeding and 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.

Objectives:

- 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.
- To impart theoretical knowledge and practical skills about plant breeding objectives,modes of reproduction and genetic consequences, breeding methods for crop improvement.

Learning Outcomes

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

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

COURSE CONTENT

(THEORY)

Total Lectures = 30

UNIT I (5 Lectures)

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 (5 Lectures)

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

UNIT III (10 Lectures)

History of Plant Breeding (Pre and post-Mendalian 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 (10 Lectures)

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.

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 andApplied Genetics.
9. Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons.
10. Chopra VL. 2001. Breeding Field Crops. Oxford & IBH.

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

PRINCIPLES OF CYTOGENETICS

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMML102

Course Title: Principles of Cytogenetics

Credits: 3 + 0 (3 Theory + 0 Practicals)

Level of Study: PG

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

Recommended Year /Semester: Plant Breeding & 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.

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

Learning Outcomes:

On completion of the course, students are able to understand Theoretical knowledge and computation skills regarding component of variation andvariances, scales, mating designs and gene effects and explian 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

COURSE CONTENT

(THEORY)

Total Lectures = 45

UNIT I (5 Lectures)

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 (10 Lectures)

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 (10 Lectures)

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 (10 Lectures)

Inter-varietal chromosome substitutions; Polyploidy and role of polyploids in crop breeding; Evolutionary advantages of autopolyploidsvs 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 (10 Lectures)

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 Mirotomist'sFormulatory 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

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

MOLECULAR CELL BIOLOGY

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMML103 **Course Title: Molecular Cell Biology**

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

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

Recommended Year /Semester: Plant Breeding Molecular Genetics-Master of Science, Year1/ 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.

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

Learning Outcomes

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

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

COURSE CONTENTS

THEORY

Total Lectures = 45

UNIT 1: Cell Structure and Function (9 Lectures)

Subtopics:

Overview of cell structure and organization

Cell membrane structure and transport mechanisms

Cytoskeleton and cell motility

Cell cycle and cell division

UNIT 2: Cellular Signaling and Communication (9 Lectures)

Subtopics:

Introduction to cell signaling

Signal transduction pathways and second messengers

Receptor-mediated signaling

Intracellular signaling networks

UNIT 3: Gene Expression and Regulation (9 Lectures)

Subtopics:

DNA structure and packaging

Transcription and RNA processing

Translation and protein synthesis

Regulation of gene expression

UNIT 4: Cell Death and Cell Senescence (9 Lectures)

Subtopics:

Apoptosis and programmed cell death

Autophagy and cell survival mechanisms

Cellular senescence and aging

UNIT 5: Cell-Cell Interactions and Tissue Homeostasis (9 Lectures)

Subtopics:

Cell adhesion molecules and cell junctions

Extracellular matrix and cell-matrix interactions

Cell communication in tissue development and repair

Stem cells and tissue regeneration

SUGGESTED READINGS / REFERENCE BOOKS/ TEXTBOOKS

1. Molecular Biology of Gene by Watson, Baker, Bell
2. Lodish, et al. Molecular Cell Biology. 5th ed. New York,NY: W.H. FreemanandCompany, 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. EssentialCellBiology 4th ed. Garland Science. ISBN: 978-0-8153-4454-4.

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

BIOCHEMISTRY

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMML104

Course Title: Biochemistry

Credits: 2 + 0 (2 Theory + 0 Practicals)

Level of Study: PG

Mode of delivery planned learning activities and teaching method: Lecture 2 hrs weekly

Prerequisites for registration: Registration of a student in various courses in consultationwith 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 post graduate life science.

Objective: On completion of the course, the student should be able to:

Microbial Physiology is the study of structure, function, energy metabolism, growth and regulatory mechanisms of microorganisms. In this course, the students will learn about the metabolic diversity exhibited by microorganisms, their thermodynamics and regulatory networks that support their survival and growth.

Learning Outcomes: Students will be able to understand microbial Biochemistry-Carbohydrate, Cell membrane and transport, Energy production in bacteria, Enzyme-Classification and nomenclature and Photosynthetic bacteria and cyanobacteriainterpret and apply nutrition concepts to evaluate and improve the nutritional health of communities.

COURSE CONTENTS

THEORY

Total Lectures = 30

Unit I: Structures & Functions of Proteins & Enzymes (7 Lectures)

Amino acids & Peptides, Proteins: Determination of Primary Structure, Proteins: Higher orders of structure, Proteins: Myoglobin & Hemoglobin, Enzymes: Mechanism of Action, Enzymes: Kinetics, Enzymes: Regulation of Activities, Bioinformatics & Computationalbiology

Bioenergetics & The Metabolism of Carbohydrates & Lipids

Bioenergetics: The role of ATP, Biologic Oxidation, The Respiratory Chain & Oxidative Phosphorylation, Carbohydrates of Physiologic Significance, Lipids of Physiologic Significance, Overview of Metabolism & the provision of metabolic Fuels, The Citric acid cycle: The catabolism of Acetyl- Co A, Glycolysis & the Oxidation of Pyruvate, Metabolism

of Glycogen, Gluconeogenesis & the Control of blood glucose, The pentose phosphate pathway & other pathways of hexose metabolism

Unit II: Metabolism of Proteins & Amino Acids (4 Lectures)

Biosynthesis of the nutritionally Nonessential amino acids, Catabolism of Proteins & of amino acid nitrogen, Catabolism of the carbon skeletons of amino acids, Conversion of Amino Acids to Specialized products, Polyphyrins& Bile pigments.

Unit III: Structure, Function & Replication of Informational Macromolecules (10 Lectures)

Nucleotides, Metabolism of Purine & Pyrimidine nucleotides, Nucleic acid, Structure & function, Nucleic acid structure & function, DNA Organization, Replication, & Repair, RNA synthesis, Processing & Modification, Protein Synthesis & genetic code, Regulation of gene expression, Molecular genetics, Recombinant DNA, & Genomic Technology

Unit IV: Biochemistry of Extracellular & Intracellular Communication (9 Lectures)

Membranes: Structure & Function, The Diversity of Endocrine system, hormone action & Signal Transduction, Nutrition, Digestion & Absorption, Micronutrients: Vitamins & Minerals, Free radicals and Antioxidant Nutrients

Suggested Reading/ Reference Books/ Text Books

1. Berg,J.M., Stryer,L(2002) Biochemistry W.H Freeman&Company
2. Nelson,D.L.,Cox,M(2008) Lehninger's Principles of Biochemistry Mac Millan
3. Voet,D and Voet, J.G (2010) Biochemistry 4th edition Wiley
4. Jain,J.L(2005)Fundamentals of Biochemistry 6 th edition S.Chand&Co
5. Deb,A.C(2001) Fundamentals of Biochemistry New Central Book Agency(P) Ltd
6. Pelczar,M.J., Chan,E.C.S and Kraig(1977) Microbiology Mc Graw-Hill
7. Talaro, K.P. ,and Talaro A(2004) Foundations of Microbiology 5 th edition Mc Graw-Hill
8. Aneja, K.R., Jain ,P. and Aneja, R(2008)Text book of Basic and Applied MicrobiologyNew Age International
9. Harper's Illustrated Biochemistry 28th edition
10. Fundamentals of Biochemistry 2nd edition by Donald Voet, Judith G. Voet, Charlotte W.Pratt

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. SambhajinagarFaculty:

Basic and Applied Sciences

PLANT PHYSIOLOGY & DEVELOPMENT

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breedingand Molecular Genetics

Course Code: MGMML105

Course Title: Plant Physiology & Development

Credits: 2 + 0 (2 Theory + 0 Practicals)

Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Lecture 2 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.

Objective:

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

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

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.

COURSE CONTENTS

THEORY

Total Lectures = 30

Unit I: Cell and Water (8 Lectures)

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 movementAntitranspirants.

Unit II: Physiology of water stress in plants (5 Lectures)

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 (9 Lectures)

Photosynthesis and its importance in bio productivity. Photochemical process, photochemical reactions,CO_2 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 ofenvironmental 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 (N_2, NO_3 and NH_3) and their reduction to aminoacids,

Protein synthesis and nucleic acids.

UNIT IV: Growth and Development, Photo-morphogenesis (8 Lectures)

Growth and differentiation. Hormonal concept of growth and differentiation, plant growth hormones and their physiological role. Synthetic growth regulators, growth retardants., Apical dominanace, senescence, fruit growth, abscission. Photo-morphogenesis: Photo receptors, phyto-chrome, crypto-chrome, Physiology of flowering- Photo-periodism and Vernalisation.

Suggested Readings/ Reference Books / Text Books

1. Hopkins WG & Huner NPA. 2004. Introduction to PlantPhysiology. 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

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

MINI PROJECT (PRACTICAL)

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMMJ106

Course Title: Mini Project (Practical)

Credits: 0 + 2 (0 Theory + 2 Practicals)

Level of Study: PG

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

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

Course Outcomes:

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

COURSE CONTENTS

PRACTICAL

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:

SN	Activities	Responsibilities
1	PG students are decide on thire team members for their semester project with their proposed project domain and title	Project head, PG students
2	Director shall allocate the project guide based on their area of expertise (ot more than 3 batches to a guide)	Director
3	Ensuring that students have regular discussion meetingswith their project guides.	Project guide Project head
4	Synopsis preparation and submission	Project head
5	Verification of student project log book	Project guide Project head
6	Approval of PPT : Abstract,existing, proposed system. 30%of proposed work. 80% of proposed work. 100% of proposed work.	Project guide
7	Preparation and submission of progress report during project	Students Project head
8	Preparaing list for Redo students (insufficient content, plagiarism, poor presentation, genuiene absentees.	Project head
9	Submission of hard copy of project report	Project head
10	Evaluation of project report	External examiner
11	Organizing final project viva-voce	Project heads
12	Ensuring that if a candidate fails to submit the project report on or before the specified deadline , he/she is deemed to havefailed in the project work and shall re – enroll for the same	Project head Project guide Director

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

BREEDING FARMING (PRACTICAL)

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breedingand Molecular Genetics

Course Code: MGMEP107 **Course Title:** Breeding Farming (Practical)

Credits: 0 + 2 (0 Theory + 2 Practicals) **Level of Study: PG**

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

COURSE CONTENTS

PRACTICAL

SN	Title
1	Study of floral biology in self pollinated crops
2	Study of floral biology in cross pollinated crops
3	Methods of Emasculation in Okra
4	Visit to seed production plots and different fieldcrops and submission of report.
5	Study of pollen germination in crop plants
6	Study of pollen viability in crop plants
7	Breeding methods and hybridization techniques in Rice, maize, soybean, sorghum, pearl millet, cotton, mustard
8	Study of male sterility in Sorghum and Bajra in field or lab by staining the pollen grain
9	To study about the type of ovules
10	To study Gametogenesis in Plants
11	Study of male sterility and self-incompatibility in crops
12	Study heterosis breeding methods in crops
13	Estimation of heterosis in crop Plants
14	Induction of Mutagenesis in vegetable crops
15	Study the heterosis fixation methods in crops

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

CYTOGENETICS LAB (PRACTICAL)

Institite: Institute of Biosciences andTechnology

Degree Program: M.Sc. Plant Breedingand Molecular Genetics

Course Code: MGMEP108 **Course Title:** Cytogenetics Lab (Practical)

Credits: 0 + 2 (0 Theory + 2 Practicals) **Level of Study: PG**

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

COURSE CONTENTS

PRACTICAL

1. Study of cytological techniques
2. Study of compound microscope
3. Preparation of specimen for observation.
4. Study of Mitosis in crop plants
5. Study of Meiosis in crop plants
6. Study of Micrometery and study of pollen grain of agricultural crop
7. Study of staining and preparations of permanent slides
8. Study of Polyploidy.
9. Study of induction of haploids (Anther culture & Ovule culture)
10. Study of somaclonal variation
11. Study of distant hybridization in field crops
12. Structural aberrations: Deletion, Duplication, Inversion – Eleuthrine bulbosa, Translocation – Rhoeo
13. Sex Chromosomes in plants

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

BREEDING LAB (PRACTICAL)

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breedingand Molecular Genetics

Course Code: MGMEP109 **Course Title:** Breeding Lab (Practical)

Credits: 0 + 2 (0 Theory + 2 Practicals) **Level of Study: PG**

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

COURSE CONTENTS

PRACTICAL

SN	Title
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 Maintence of Micro- organism from different environment.
14	Isolation of Rhizobium from nodule and Gram Staining of Rhizobial cells.

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

BASIC CONCEPTS IN LABORATORY TECHNIQUES (PRACTICAL)

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breedingand Molecular Genetics

Course Code: MGMEP110 **Course Title:** Basic Concepts in Laboratory Techniques (Practical)

Credits: 0 + 2 (0 Theory + 2 Practicals) **Level of Study: PG**

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

COURSE CONTENTS

PRACTICAL

1. Safety measures while in Lab;
2. Handling of chemical substances;
3. Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware;
4. Drying of solvents/chemicals.
5. Weighing and preparation of solutions of different strengths and their dilution;
6. Handling techniques of solutions;
7. Preparation of different agro-chemical doses in field and pot applications;
8. Preparation of solutions of acids; Neutralization of acid and bases;
9. Preparation of buffers of different strengths and pH values.
10. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthing.
11. Preparation of media and methods of sterilization;
12. Seed viability testing, testing of pollen viability;
13. Tissue culture of crop plants;
14. Description of flowering plants in botanical terms in relation to taxonomy

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

RESEARCH METHODOLOGY

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breedingand Molecular Genetics

Course Code: **Course Title:** Research Methodology

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

Mode of delivery planned learning activities and teaching method: Practical

4 hrs /weekly

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

Year I/Semester I

Objectives:

- To get introduced to research philosophy and process in general
- To be able to formulate the problem statement and research plan for theproblemunderinvestigation
- To be able to apply various numerical/ quantitative techniques for data analysis
- To be able to communicate the research findings effectively

COURSE CONTENTS

THEORY (Total Lectures = 60)

Unit I: (12 Lectures)

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Unit II: (12 Lectures)

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. Research Design: Meaning of Research Design, Need for Research Design, Features of a Good

Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Unit III: (12 Lectures)

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling:Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method**.**

Unit IV: (12 Lectures)

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests**.**

Unit V: (12 Lectures)

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Suggested Readings

1. 'Management Research Methodology' by K.N. Krishnaswamy, Appa Iyer Sivakumar & M. Mathirajan, Person Education.
2. 'Research Methodology. G.C. Ramamurthy, Dream Tech Press, New Delhi
3. 'Research Methodology: A Step by Step Guide for Beginners' by Ranjit Kumar, 2nd Edition
4. 'Research Methodology: An Introduction for Science and Engineering Students', byStuart Melville and Wayne Goddard
5. 'Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville 'Research Methodology: Methods and Techniques', by Dr. C.R. Kothari, New AgeInternational Publisher

MGM UNIVERSITY, CHH. SAMBHAJINAGAR

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Basic and Applied Sciences

Post Graduate (PG) progrmme

Plant Breeding and Molecular Genetics - CURRICULUM

w. e. f. Academic Year 2023-24

M.Sc. Plant Breeding and Molecular Genetics

CURRICULUM: Semester II

Semester II (M.Sc. PBMG)																			
Level	**Course Code**	**Course Title**	**Type**	**Course Type**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6	**MGMML111**	**Principles of Quantitative Genetics**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	0	40
	MGMML112	**Recombinant DNA Technology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	0	40
	MGMML113	**Maintenance Breeding, Concept of Variety Release & Seed Production**	**Theory**	**Major Mandatory**	3	-	3	10	10	10	-	20		50		8	0	20
	MGMML114	**Breeding for Biotic & Abiotic Stress Resistance**	**Theory**	**Major Mandatory**	3	-	3	10	10	10	-	20	-	50	-	8	0	20
	MGMEP115	**1. Maintenance Breeding Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	8	0	20
	MGMEP116	**2. Plant Breeding Molecular Lab**																
	MGMEP117	**1. Quantitative Genetics Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-		8	20
	MGMEP118	**2. Breeding for Biotic and Abiotic Stress Resistance Lab**																
	MGMMJ119	**Micro Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-		8	20
	MGFPJ120	**Field Project**	**FP**	**FP**	-	8	4	-	-	-	60	-	40	100	-	-	16	40
		Total (L- P) Hrs / week = 32			**12**	**20**	**22**	**60**	**60**	**60**	**150**	**120**	**100**	**550**		**56**	**32**	**220**

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

PRINCIPLES OF QUANTITATIVE GENETICS

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMML 111

Course Title: Principles of Quantitative Genetics

Credits: 3 + 0 (3 Theory + 0 Practicals)

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 bementioned in the roster form

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

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 explian in details

COURSE CONTENTS

THEORY

UNIT-I (8 Lectures)

Mendelian traits vs polygenic traits - nature of quantitative traits and its inheritance -

Multiple factor hypothesis - analysis of continuous variation; Variations associated withpolygenic traits - phenotypic, genotypic and environmental-non-allelic interactions;Nature of gene action– additive,dominance,epistatic and linkage effects.

UNIT II (9 Lectures)

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 D2 analyses -

Association analysis - phenotypic and genotypic correlations; Path analysis and Parent -

progeny regression analysis;

Discriminant function and principal componentanalyses; Selection indices - selection of parents;

Simultaneous selection models- concepts of selection - heritability and genetic advance.

UNIT III (9 Lectures)

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 xenvironment interaction- adaptability

and stability; Models for GxE analysis and stability parameters; AMMI analysis – principlesand interpretation.

UNIT IV (9 Lectures)

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

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

UNIT V (10 Lectures)

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- selectionbased 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 Geneticsand
6. Biometrical Techniques in Plant Breeding.Kalyani.
7. Naryanan SS & Singh P. 2007. Biometrical Techniques in PlantBreeding.Kalyani.

8. Singh P & Narayanan SS. 1993. Biometrical Techniques inPlantBreeding.Kalyani.
9. Singh RK & Choudhary BD. 1987. Biometrical Methods in Quantitative Genetics.Kalyani.

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

RECOMBINANT DNA TECHNOLOGY

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMML 112 **Course Title: Recombinant DNA Technology**

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

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

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 impart theoretical knowledge of recombinant DNA Technology in plant breeding.

COURSE CONTENTS

THEORY

Total Lectures = 45

UNIT I (9 Lectures)

Introduction to RDT:

Overview of major steps involved

Tools for RDT:

Enzymes:

- Restriction endonucleases: Types and characteristic features; Nomenclature;Modification of cut ends
- DNA ligases
- Other enzymes:A brief account of Alkaline phosphatase, Polynucleotide kinase, Exonuclease III, DNase I, DNA polymerase and Klenow fragment, Terminal nucleotidyl transferase, RNA dependentDNAPolymerase.

Vectors:

- Properties of an ideal vector
- Types : Cloning and expression vectors

i) Cloning vectors: i) Prokaryotic vectors: Plasmids- pBR 322; pUC 18;Bacteriophages- Lambda phage, Cosmids.

ii) Eukaryotic vectors: YAC vectors; Shuttle vectors- Yeast and *E. coli*.

iii) For higher plants: Integrative DNA transfer- *Agrobacterium* vectors-Ti plasmid-Binary andCo integrated vectors; Non integrative

DNA transfer-Plant viral vectors (CaMV)

iv) For animals: Animal viral vectors- SV 40 (3 types);

ii) **Expression vectors** in Prokaryotes and Eukaryotes

UNIT II (8 Lectures)

a. Isolation of the desired gene:

- cDNA library,
- Genomic library,
- Organo-chemical synthesis,
- Amplification through PCR

b. Direct gene transfer methods:

- Chemical methods,
- Lipofection,
- Electroporation,
- Microinjection,
- Ballistic method (Particle shot gun method)

UNIT III (9 Lectures)

c. Selection and screening of recombinants:

- Identification and selection of transformed cells:

➢ Direct methods-Insertional inactivation, Visual screening method,Plaqueformation, Complementation of mutation /nutrition

➢ Indirect methods- Colony hybridization, Immunochemical detectionUse ofselectable and scorable genes:

a) Selectable genes: Plants- npt ; Animals-TK

b) Scorable genes: Plants-Gus; Animals-lux

UNIT IV (9 Lectures)

Technique for RDT:

- Gel electrophoresis: AGE and SDS-PAGE
- Hybridization: Southern; Northern; Western; Dot blots
- Autoradiography
- DNA sequencing: Sanger’s Dideoxy method

- Molecular probes

UNIT V (10 Lectures)

Applications of RDT:

- Transgenic animals: Mouse(Knock-out; Methodology, applications);A brief account of Transgenic Sheep, , Poultry, Fish,Cow, ,
  with value added attributes
- Transgenic Plants: Resistance to diseases (Pathogen resistant- viral,fungal and bacterial); insects (Bt gene transfer); Fertilizermanagement- Nif gene transfer.

References:

- Agricultural Biotechnology- S.S. Purohit.
- An introduction to Genetic engineering (2nd ED). Desmond S.T.NichollI South Asian Edition, 2002, Cambridge University Press.
- Biotechnology; B.D. Singh, Kalyani publishers.
- Biotechnology; U. Satyanarayana; Books and Allied (P) Ltd., Kolkata, 2008.
- Biotechnology Fundamentals and applications- S.S. Purohit, student Edition,Jodhpur, 2003.
- Genetic engineering: Principles and practice; Sandhya Mitra,MacMillanIndia Ltd. 2008.
- Molecular Biotechnology; Principles and practices, Channarayappa, Universitypress(India) Private Limited, 2006.
- Genetics: From Genes to Genomes by Hartwell I.H. et. al. 2000. Mc Graw Hill.
- Genes-Volumes, Benjamin Lewin, Oxford University Press, Oxford.
- Transgenic animals by Ranga.
- Molecular Biology- Primrose.
- Molecular Biology of the gene- Watson.
- Recombinant DNA Technology- Glick Paspornak.
- Gene cloning- T. A. Brown.

SYLLABUS STRUCTURE SHEET
University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

MAINTENANCE BREEDING CONCEPT OF VARIETY RELEASE AND SEEDPRODUCTION

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMML113

Course Title: Maintenance Breeding, Concept of Variety Release and Seed Production

Credits: 3 + 0 (3 Theory + 0 Practicals)

Level of Study: PG

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

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 CONTENT

THEORY

UNIT I (9 Lectures)

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 (10 Lectures)

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 crop isolation distance; Principles of seed production; Methods of nucleus and breeder seed production.

UNIT III (9 Lectures)

Safeguards during seed production;Maintenance of varieties in self and cross-pollination crop isolation distance; Principles of seed production; Methods of nucleus and breeder seed production. Generation system of seed multiplication nucleus,breeders,foundation,certified

UNIT IV (10 Lectures)

Quality seed production technology of self and cross-pollinated crop varieties *viz*; cereals & millets (wheat, barley, paddy, pearlmillet,sorghum, maize and ragi etc.); Pulses (green gram, blackgram, cowpea, pigeonpea, chickpea, fieldpea, lentil); Oilseeds (groundnut, soybean,sesame, castor, sunflower, safflower, linseed, rapeseed and mustard); fibres (cotton, jute) and forages (guar, forage sorghum, teosinte, oats, berseem, lucerne).;

UNIT V (7 Lectures)

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. 2 nd Ed. Oxford &IBH.
2. Kelly AF. 1988. Seed Production of Agricultural Crops.Longman.
3. McDonald MB Jr & Copeland LO. 1997. Seed Production: Principles and Practices. Chapman &Hall.
4. MusilAF. 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. LeonardHill.
8. Tunwar NS & Singh SV. 1985. Handbook of Cultivars.ICAR.

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

BREEDING FOR BIOTIC AND ABIOTIC STRESS RESISTANCE

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMML114

Course Title: Breeding for Biotic and Abiotic Stress Resistance

Credits: 3 + 0 (3 Theory + 0 Practicals)

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 Advisor and acceptance by the Principal. The approved courses must be mentioned in the roster form

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

COURSE CONTENT

THEORY

UNIT I (11 Lectures)

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-defense mechanisms against viruses andbacteria.

UNIT II (10 Lectures)

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 (12 Lectures)

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 (6 Lectures)

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 andenvironment.

UNIT V (6 Lectures)

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, chitnases and Bt for diseases and insect pest management-Achievements.

Suggested Readings/ Reference Books / Text Books

1. Blum A. 1988. Plant Breeding for Stress Environments. CRCPress.
2. Christiansen MN & Lewis CF. 1982. Breeding Plants for LessFavourable Environments. WileyInternational.
3. Fritz RS & Simms EL. (Eds.). 1992. Plant Resistance to Herbivoresand Pathogens:Ecology,Evolution and Genetics. The University of ChicagoPress.
4. Li PH & Sakai A. 1987. Plant Cold Hardiness. Liss, NewYork
5. LuginpillP. 1969. Developing Resistant Plants - The Ideal Method ofControlling Insects. USDA,ARS, WashingtonDC.
6. Maxwell FG & Jennings PR. (Eds.). 1980. Breeding Plants Resistant toInsects. John Wiley &Sons.
7. Painter RH. 1951. Insect Resistance in Crop Plants. MacMillan, NewYork.
8. Russel GE. 1978. Plant Breeding for Pest and Disease Resistance.Butterworths.

Sakai A &LarcherW. 1987. Frost Survival in Plants.Springer-Verlag.

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

MAINTENANCE BREEDING LAB

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMEP115 **Course Title:** Maintenance Breeding Lab

Credits: 0+2 (0 Theory + 2 Practicals) **Level of Study: PG**

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

1. Plant Breeder's Kit
2. Selfing , Emasculation and crossing technique.
3. Botanical description and floral biology ; Floral morphology, Selfing emasculation and crossing techniques in Cotton.
4. Botanical description and floral biology ; Floral morphology, Selfing emasculation and crossing techniques in Sorghum
5. Botanical description and floral biology ; Floral morphology, Selfing emasculation and crossing techniques in Pigeonpea
6. Botanical description and floral biology ; Floral morphology, Selfing emasculation and crossing techniques in Sunflowers
7. Botanical description and floral biology ; Floral morphology, Selfing emasculation and crossing techniques in Maize
8. Botanical description and floral biology ; Floral morphology, Selfing emasculation and crossing techniques in Chilli
9. Botanical description and floral biology ; Floral morphology, Selfing emasculation and crossing techniques in Okra
10. Selection methods in segregating populations
11. Evaluation of breeding material
12. Analysis of variance (ANOVA
13. Estimation of heritability and genetics advance
14. Use of male – sterility in field crops
15. Maintenance of experimental records
16. Techniques in hybrids seed production

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

PLANT BREEDING MOLECULAR LAB

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMEP116 **Course Title:** Plant Breeding Lab

Credits: 0+2 (0 Theory + 2 Practicals) **Level of Study: PG**

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

COURSE CONTENT

PRACTICALS

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.
8. Use of descriptors for cataloging – Floral biology- emasculationpollination techniques; Study of range of variation for yield and yield components- study of segregating populations in Greengram, Blackgram Attempting crosses between blackgram and greengram.
9. Use of descriptors for cataloging – Floral biology- emasculationpollination techniques; Study of range of variation for yield and yield components- study of segregating populations in other pulse crops.
10. Use of descriptors for cataloging – Floral biology, emasculation, pollination techniques of oilseed crops like Sesame and Groundnut
11. Use of descriptors for cataloging – Floral biology, emasculation, pollination techniques of oilseed crops like Sunflower and Caster
12. Cotton: Use of descriptors for cataloging- Floral biology-learning on the crosses between different species
13. Cotton -fiber quality evaluation- conventional and modern approaches; analyzing the lint samples of differentspecies, inter-specific and interracial derivatives for fiber quality and interpretation
14. Development and maintenance of male sterile lines Evaluation of cotton cultures of different species for insect and disease resistance

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

QUANTITATIVE GENETICS LAB

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMEP117 **Course Title:** Quantitative Genetics Lab

Credits: 0+2 (0 Theory + 2 Practicals) Level of Study: PG

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

1. Working out the efficiency of selection methods in different populations and interpretation
2. Biparental mating –use of softwares in analysis and result interpretation
3. Triallel analysis- use of softwares in analysis and result interpretation
4. Quadriallel analysis- use of softwares in analysis and result interpretation
5. Triple test cross (TTC)- use of softwares in analysis and result interpretation
6. Advanced biometrical models for combining ability analysis
7. Selection of stable genotypes using stability analysis, Models in stability analysis
8. Additive main effect and Multiplicative interaction (AMMI)
9. Principal Component Analysis model
10. Shifted multiplicative model
11. Analysis and selection of genotypes; Methods and steps to select the best model
12. Selection systems
13. Biplots and mapping genotypes
14. Construction of linkage maps and QTL mapping
15. Strategies for QTL mapping; Statistical methods in QTL mapping
16. Phenotype and Marker linkage studies

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

BREEDING FOR BIOTIC AND ABIOTIC STRESS RESISTANCE LAB

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMEP118 **Course Title:** Breeding for Biotic and Abiotic Stress Resistance Lab

Credits: 0+2 (0 Theory + 2 Practicals) **Level of Study: PG**

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

COURSE CONTENT

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 thecrops;
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 andbacteria;
9. Symptoms and data recording; use of MAS procedures -
10. Screening forage crops for resistance to sewage water and tanneryeffluents;
11. Quality parameters evaluation -
12. Screening crops for drought and floodresistance;
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 bioticfactors and abiotic stress - ways of combating them.

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

MICRO PROJECT

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGMMJ119

Course Title: Micro Project (Practical)

Credits: 0 + 2 (0 Theory + 2 Practicals)

Level of Study: PG

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

Recommended Year /Semester: Plant Breeding & Molecular GeneticsYear 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.

Course Outcomes:

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

COURSE CONTENT

PROJECT

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

SN	Activities	Responsibilities
1	PG students are decide on thire team members for their semester project with their proposed project domain and title	Project head, PG students
2	Director shall allocate the project guide based on their areaof expertise (ot more than 3 batches to a guide)	Director
3	Ensuring that students have regular discussion meetingswith their project guides.	Project guideProject head
4	Synopsis preparation and submission	Project head
5	Verification of student project log book	Project guide Project head
6	Approval of PPT : Abstract,existing, proposed system. 30% of proposedwork.80% of proposed work. 100% of proposed work.	Project guide
7	Preparation and submission of progress report during project	Students Project head
8	Preparaing list for Redo students (insufficient content, plagiarism, poor presentation, genuiene absentees.	Project head
9	Submission of hard copy of project report	Project head
10	Evaluation of project report	External examiner
11	Organizing final project viva-voce	Project heads
12	Ensuring that if a candidate fails to submit the project report on or before thespecified deadline , he/she is deemed to have failed in the project work and shall re – enroll for the same	Project head Project guide Director

SYLLABUS STRUCTURE SHEET

University: MGM University, Chh. Sambhajinagar

Faculty: Basic and Applied Sciences

FIELD PROJECT

Institite: Institute of Biosciences and Technology

Degree Program: M.Sc. Plant Breeding and Molecular Genetics

Course Code: MGFPJ120

Course Title: Field Project (Practical)

Credits: 0 + 4 (0 Theory + 4 Practicals)

Level of Study: PG

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

Recommended Year /Semester: Plant Breeding & Molecular GeneticsYear 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.

Course Outcomes:

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

COURSE CONTENT

PROJECT

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