MGM UNIVERSITY, CHH. SAMBHAJINAGAR

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Sciences

Post Graduate (PG) program

Plant Biotechnology – CURRICULUM

(w. e. f. Academic Year 2023-24)

M.Sc. Plant Biotechnology

Prepared By
Dr. A. B. Kshirsagar

Submitted By
Dr. G. W. Narkhede

Approved By
Board of Studies

CURRICULUM

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Appendix-2023																			
PROGRAMME: M.Sc. Plant Biotechnology																			
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	**MPMML101**	**Plant cell, Tissue and Organ Culture**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMML102	**Biochemistry**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	-	20
	MPMML103	**Molecular Cell Biology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMML104	**Plant Physiology and Development**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	-	20
	MPMMJ105	**Mini Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30		20	50	-	-	8	20
	MPMEP106 **MPMEP107**	**1. Plant Science Lab** **2. Plant Functional Genomics Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30		20	50	-	-	8	20
	MPMEP108 **MPMEP109**	**1. Plant Lab** **2. Bioinformatics Lab in Plant Biotechnology**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	0	20	50	-	-	8	20
	-	**Research Methodology**	**Theory**	**RM**	4	-	4	20	20	20	-	40	-	100	-	16	-	40
		Total (L- P) Hrs / week = 26			**14**	**12**	**20**	**80**	**80**	**80**	**90**	**160**	**60**	**550**		**64**	**24**	**220**

Semester II (M.Sc. PBT)																		
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	**MPMML110**	**Protein Engineering for Industrial Plant Biotech**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMML111	**Recombinant DNA Technology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMML112	**Bioinformatics and Functional Genomics**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMML113	**Natural Products from Plants**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMEP114 MPMEP115	**1. Biomolecular Technologies 2. Plant Biochemistry and Biotechnology Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MPMEP116 MPMEP117	**1. Culture Laboratory 2. Computational & System Biology Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MPMMJ118	**Micro Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MPFPJ119	**Field Project**	**FP**	**FP**	-	8	4	-	-	-	60	-	40	100	-	-	16	40
		Total (L- P) Hrs / week = 32			**12**	**20**	**22**	**80**	**80**	**80**	**150**	**160**	**100**	**650**		**64**	**40**	**260**

Level 6.0 Award of PG Diploma (42 Credits) after Three Year UG Degree

Semester III (M.Sc. PBT)																			
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	**MPMML201**	**Target Traits for Crop Improvement**	**Theory**	**Major Mandatory**	4	-	4	20	20	20	-	40	0	100	-	16	0	40
	MPMML202	**Plant Breeding and Biotechnology**	**Theory**	**Major Mandatory**	4	-	4	20	20	20	-	40	0	100	-	16	0	40
	MPMML203	**Advances in Crop Biotechnology**	**Theory**	**Major Mandatory**	4	-	4	20	20	20	-	40	-	100	-	16	0	40
	MPMEP204 MPMEP205	**1. Techniques in Molecular Biology 2. Plant Biotechnology for Crop Improvement**	**Practical**	**Major Elective**	-	8	4	-	-	-	60	0	40	100	-	0	16	40
	MPRPJ206	**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. PBT)																			
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	**MPMEL207 MPMEL208**	**1. Ethics/ Biosafety/ IPR 2. Structural Genomics and Proteomics**	**Theory**	**Major Elective**	4	-	4	20	20	20	-	40	-	100	-	16	-	40
	MPJTI209	**On Job Training**	**OJT**	**Major Mandatory**	-	20	10	-	-	-	200	-	50	250	-	-	20	50
	MPRPJ210	**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 84 credits OR Four Years UG Degree with 42 credits

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(w. e. f. Academic Year 2023-24)

M.Sc. Plant Biotechnology

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	MPMML102	**Biochemistry**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	-	20
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	MPMML104	**Plant Physiology and Development**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	-	20
	MPMMJ105	**Mini Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30		20	50	-	-	8	20
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	-	**Research Methodology**	**Theory**	**RM**	4	-	4	20	20	20	-	40	-	100	-	16	-	40
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DETAILED SYLLABUS

PLANT CELL, TISSUE AND ORGAN CULTURE

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic and Applied Sciences

Institute: Institute of Biosciences & Tech. **Degree:** M.Sc. Plant BiotechnologyTechnology

Course Code: MPMML101 **Course Title:** Plant cell, Tissue, and Organ culture

Credits allocated: 3+0 (3 Th+ 0 Pr) **Level of Study:** Post-Graduate (PG)

Mode of delivery, planned learning, and teaching method: Lecture: 3 hr weekly

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 have passed in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive exposure to the knowledge of plant tissue cultures, basic principle, methods, and techniques and their applications. The laboratory exercises provide hands-on experiences with experiments and training in tissue cultures for plants.

Objective: After the end of this course, students will be able to:
Comprehend the fundamental concepts of plant tissue culture. They will understand different methods for plant tissue culture and cell culture.

COURSE CONTENT: UNIT-WISE SYLLABUS

Theory

Unit 1: Basics of plant tissue culture (9 Lectures)

Introduction to Laboratory Facilities, Operation, and Management, Media Preparation and Handling, Sterile Techniques, Micropropagation by Proliferation of Axillary Buds, Adventitious Shoot Proliferation, Plant Regeneration by Organogenesis from Callus and Cell Suspension Cultures, Plant Regeneration from Callus and Cell Suspension Cultures by Somatic Embryogenesis, Direct Somatic Embryogenesis, Conifer Somatic Embryogenesis, Embryo Development, Maturation Drying, and Plant Formation.

Unit 2: Methods and types of tissue and organ culture (9 Lectures)

Meristem Culture for Virus Elimination, Embryo Culture and Embryo Rescue for Wide Cross Hybrids, Anther Culture for Doubled Haploid Production, Microspore Culture for Haploid Plant Production, Haploid Induction in Cereals, Monoploid Production by Chromosome Elimination, Protoplast Isolation and Culture**,** Agrobacterium-Mediated Transformation, Direct DNA Transfer into Intact Plant Cells Via Microprojectile Bombardment.

Unit 3: Cell, Tissue, and Organ Culture of Important crops (9 Lectures)

Cell, Tissue, and Organ Culture in Sugarcane Improvement, Propagation of Ornamentals by Tissue Culture, Tissue Culture in the Orchid Industry, Tissue Culture in the Citrus Industry, Applications of Tissue Culture in Forestry, Applications of Tissue Culture in the Improvement of Coffee, Large Scale Propagation of Strawberry Plants from Tissue Culture, Tissue Culture Studies on Cereals, Ovule Culture: Fundamental and Pragmatic Research for the Cotton Industry, Regeneration of Plants from Tissue Cultures.

Unit 4: Bioengineering aspect of tissue culture and evaluation (9 Lectures)

Evaluation of plant suspension cultures by texture analysis, Bioengineering aspects of bioreactor application in plant propagation, Agitated, thin-films of liquid media for efficient micropropagation, Design, development, and applications of mist bioreactors for micropropagation and hairy root culture, Bioreactor engineering for recombinant protein production using plant cell suspension culture, Types and designs of bioreactors for hairy root culture, Oxygen transport in plant tissue culture systems, Temporary immersion bioreactor, Design and use of the wave bioreactor for plant cell culture, Integrating automation technologies with commercial micropropagation, Machine vision and robotics for the separation and regeneration of plant tissue cultures, Closed systems for high quality transplants using minimum resources, Aeration in plant tissue culture, Tissue culture gel firmness: measurement and effects on growth.

Unit 5: Plant tissue culture opportunities for metabolite production (9 Lectures)

Drug Discovery from Plants, Grapevine Stilbenes and Their Biological Effects, Research into Isoflavonoid Phyto-oestrogens in Plant Cell Cultures, Secondary Metabolite Production from Plant Cell Cultures: the Success Stories of Rosmarinic Acid and Taxol, Guggulsterone: a Potent Natural Hypolipidemic Agent from Commiphora wightii – Problems, Perseverance, and Prospects, Silybum marianum (L.) Gaertn: the Source of Silymarin, The Production of Dianthrones and Phloroglucinol Derivatives in St. John's Wort, Production of Alkaloids in Plant Cell and Tissue Cultures, Bacopa monnieri, a Nootropic Drug, Chemical Profiling of Nothapodytes nimmoniana for Camptothecin, an Important Anticancer Alkaloid: Towards the Development of a Sustainable Production System, Colchicine – an Overview for Plant Biotechnologists.

Suggested Readings/References Books/ Text Books

1) Bioactive Molecules and Medicinal Plants, Kishan Gopal Ramawat

   Jean-MichelMérillon Eds.

2) Applied and Fundamental Aspects of Plant Cell, Tissue, and Organ Culture, Reinert and

   Y. P. s. Bajaj.

3) Plant Tissue Culture Engineering, s. Dutta Gupta Kharagpur and Yasuomi Ibaraki.

BIOCHEMISTRY

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Unit Code: MPMML102 **Course Unit Title:** Biochemistry

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

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

Recommended Year /Semester: Biotechnology Masters 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.

Candidate should pass in post graduate life science.

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 cyanobacteria interpret and apply nutrition concepts to evaluate and improve the nutritional health of communities.

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.

COURSE CONTENT: UNIT-WISE SYLLABUS

Theory

Unit 1: 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 & Computational biology

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 2: 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 toSpecialized products, Polyphyrins& Bile pigments.

Unit 3: 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 4: Biochemistry of Extracellular & Intracellular Communication (9 Lectures)

Membranes: Structure & Function, The Diversity of Endocrine system, hormone action & SignalTransduction, 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 Microbiology NewAge International
9.Harper's Illustrated Biochemistry 28th edition
10.Fundamentals of Biochemistry 2nd edition by Donald Voet, Judith G. Voet, Charlotte W. Pratt11.Principles of Biochemistry 5th edition by Michael M. Cox & David L. Nelson
12.Biochemistry by U. Satyanarayana & U. Chakrapan

MOLECULAR CELL BIOLOGY

University: MGM University, CHH. SAMBHAJINAGAR

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Tech.

Degree: M.Sc. Plant Biotechnology

Course Unit Code: MPMML103 **Course Unit Title:** Molecular Cell Biology

Credits allocated: 3 (3 Th+0 Pr) **Level of Study:** PG

Mode of delivery, planned learning, and teaching method: Lecture: 3 hr weekly

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 have passed in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive exposure to the knowledge of molecular biology, structure and function of informational molecules, the flow of genetic information, bonding pattern of Macromolecular structure, Recombination, and Repair and replication of genetic material, concept of gene expression and regulation.

Objective: After the end of this course, students will be able to:

Comprehend the fundamental concepts of molecular biology, They will understand about flow of genetic information, concept of gene expression and its regulation.

COURSE CONTENT: UNIT-WISE SYLLABUS

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.

Plant Physiology & Development

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Plant Biotechnology

Institute: Institute of Biosciences and Technology **Degree:** M.Sc. Plant Biotechnology

Course Unit Code: MPMML104 **Course Unit Title:** Plant Physiology and Development

Credits allocated: 2+0 (2 Th+0 Pr) **Level of Study:** PG

Mode of delivery, planned learning, and teaching method: Lecture: 2 hr weekly

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 have passed in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive exposure to the knowledge of Plant Physiology & Development, plant cell and water relationship, biochemistry and metabolism of plant cell photosynthesis, growth and development, flowering mechanisms, and stress regulation in plants.

Objective: After the end of this course, students will be able to:

Comprehend the fundamental concepts of Plant Physiology & Development, basic metabolism of plant cell, growth and development and stress regulation in plant.

COURSE CONTENT: UNIT-WISE SYLLABUS

THEORY

Unit I: Cell and Water (8 Lectures)

Cell organelles and their physiological functions, structure and physiological functions of cellwall, 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 (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 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 (N_2, NO_3 and NH_3) and theirreduction to amino acids, Protein synthesis and nucleic acids.

UNIT IV: Growth and Development, Photo-morphogenesis (4 Lectures)

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 (4 Lectures)

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 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

MINI PROJECT

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic & AppliedScience

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMMJ105 **Course Title:** Mini project

Credits allocated: 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 coursesmust be mentioned in the roster form. Candidate should have passed in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive exposure to project work.

Objective: After the end of this course, students will be able to understand the concepts of project work based on their idea, design of objective, methodology, and execution of project work, writing synopsis and interpreting the results.

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.

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:**

1. Use the data analysis tools for findings
2. The individual and group activity (2-3 – Discussion with project coordinator) student's effort and commitment.
3. The quality of the work produced by the individual student.
4. The student's integration and co-operation with the rest of the group.
5. The completeness of the logbook & time to time signature of guide

Plant Science Lab (Practical)

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMEP106 **Course Title:** Plant Science Lab (P)

Credits allocated: 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 coursesmust be mentioned in the roster form. Candidate should have passed in Under Graduate Life Sciences.

Course content

1. Description of species based on herbarium and live specimens.
2. Identification (Families and binomials) of specimens belonging to the families.
3. Study of dividing cells - squash and smear techniques.
4. Calculation of various patterns in fruits/leaves/seeds.
5. Determination of solute particles in plant tissues
6. Effect of temperature, detergent and solvents on membrane permeability
7. Estimation of starch
8. Estimation of amino acids
9. Estimation of Photosynthetic pigments from the given leaf (chlorophyll a and total chlorophyll)

Plant Functional Genomics Lab (Practical)

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMEP107 **Course Title:** Plant Functional Genomics Lab

Credits allocated: 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 coursesmust be mentioned in the roster form. Candidate should have passed in Under Graduate Life Sciences.

COURSE CONTENT

Practical

i. Gene Prediction Tools: GENSCAN, GRAIL, FGENESH
ii. NCBI Genomic Resources
iii. Proteomics Tools: EXPASY, CDART

Plant Lab (Practical)

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMEP108 **Course Title:** Plant Lab (P)

Credits allocated: 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 have passed in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive exposure to the knowledge and hands on basic plant biology experiments.

Objective: After the end of this course, students will be able to:

Comprehend the fundamental concepts of plant biology like seed germination, estimation of plant molecules using spectroscopic methods, isolation and analysis of plant DNA using electrophoresis techniques, microbial isolation, and maintenance, student will have hands-on routinely used techniques for plant biology experiments.

Course content

Plant Lab Practicals

1. To demonstrate the process of osmosis with the help of Potato Osmoscope.
2. To determine the seed viability.
3. Determine the rate of seed germination.
4. Estimation of chlorophyll from leaf samples and measured OD at different wavelengths.
5. Separation of chlorophyll pigment by using paper chromatography.
6. Extraction of DNA and RNA from given samples.
7. Agarose Gel Electrophoresis.
8. Methods of Isolation, Purification, and Maintenance of Micro-organism from different Environment.
9. Isolation of Rhizobium from nodule and Gram Staining of Rhizobial cells.

Bioinformatics Lab in Plant Biotechnology (Practical)

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMEP108 **Course Title:** Bioinformatics Lab in Plant Biotechnology (P)

Credits allocated: 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 have passed in Under Graduate Life Sciences.

COURSE CONTENT

Practical

UNIT I

Gene Information Resources: GenBank, EMBL, Protein Information Resources: Swiss-Prot, BLOCKS, Gene Prediction Tools: GENSCAN, GRAIL

UNIT II

Structural Databases: PDB, CSD, RELIBASE, REBASE, File Format Converter Tools: BABEL, ReadSeq, NCBI Resources

UNIT III

Visualization tools – RasMol, QMol, Swiss PDB, Pymol, Modelling Tools: MODELLER, SwissPDB, Geno3D, Docking Tools: Chimera, Dock, AutoDock, GRAMM, Hex, Argus Lab.

UNIT IV

Proteomics Tools: EXPASY, CDART, 3D-Structure Optimization Tools, Sequence Analysis Tools: BLAST, FASTA, EMBOSS, TCOFFEE, Phylogenetic Analysis Tools: Phylip, NTSYS, CLUSTALW/CLUSTALX, BIOEDIT

Research Methodology

University: MGM University, CHH. SAMBHAJINAGAR	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree:** M.Sc. Plant Biotechnology
Course Unit Code:	**Course Unit Title:** Research Methodology
Credits allocated:	**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 Sciences

Post Graduate (PG) program

Plant Biotechnology - CURRICULUM

(w. e. f. Academic Year 2023-24)

M.Sc. Plant Biotechnology

SEMESTER-II

CURRICULUM

Semester II (M.Sc. PBT)																		
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	**MPMML110**	**Protein Engineering for Industrial Plant Biotech**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMML111	**Recombinant DNA Technology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMML112	**Bioinformatics and Functional Genomics**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMML113	**Natural Products from Plants**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MPMEP114 MPMEP115	**1. Biomolecular Technologies 2. Plant Biochemistry and Biotechnology Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MPMEP116 MPMEP117	**1. Culture Laboratory 2. Computational & System Biology Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MPMMJ118	**Micro Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MPFPJ119	**Field Project**	**FP**	**FP**	-	8	4	-	-	-	60	-	40	100	-	-	16	40
		Total (L- P) Hrs / week = 32			**12**	**20**	**22**	**80**	**80**	**80**	**150**	**160**	**100**	**650**		**64**	**40**	**260**

Subject-wise course details

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic and Applied Sciences

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMML110 **Course Title:** Protein Engineering for Industrial Plant Biotech

Credits allocated: 3+0 (3 Th+ 0 Pr) **Level of Study:** Post-Graduate (PG)

Mode of delivery, planned learning, and teaching method: Lecture: 3 hr weekly

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 have passed in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive eexposure to the knowledge of biology of Protein and protein structure, Protein modification and engineering related important plants.

Objective: After the end of this course, students will be able to:

Comprehend the fundamental concepts of protein structure, prediction and engineering for important plants.

COURSE CONTENT: UNIT-WISE SYLLABUS
THEORY

Unit 1: Biology of Protein and protein structure (8 Lectures)

Biology of Proteins Basic constituents, hierarchical arrangements, over-view of protein preparation, modification, maturation; protein-protein interactions, Heat shock proteins, their structure and functions in cells, protein mimicry, assisted protein maturation processes in cells, Protein trafficking and dislocation, protein secretion from cell, biomarker discovery, ribosome profiling.

Unit 2: Protein folding and assembly (9 Lectures)

Protein folding and assembly Protein folding pathways in prokaryotes and eukaryotes; Singleand multiple folding pathways; Protein folding of single domain and multi-domain proteins;

Inclusion bodies and recovery of active proteins; Osmolyte assisted protein folding; Structure of chaperones and role of chaperones in protein folding, kinetics and thermodynamics of protein folding and unfolding reactions.

Unit 3: Protein modification and engineering (10 Lectures)

Protein modifications Strategies for protein engineering, Random and site-directed mutagenesis, Role of low-fidelity enzymes in protein engineering, Gene shuffling and Directed evolution of proteins, Antibody engineering.

Unit 4: Prediction and design of protein structures (9 Lectures)

Prediction and design of protein structures Similar structure and function of homologous proteins, Role of multiple alignment, Homology and ab-initio method for protein structure prediction, Phage display systems; Structure based drug design, Rational protein design.

Unit 5: Proteomics (9 Lectures)

Proteomics Technologies: Protein Arrays/ Protein Chips and their application, 2D Gel Electrophoresis and its application Mass Spectrometry and Protein Identification, ProteomicsDatabases Proteomics Analysis Tools at ExPaSy.

Suggested Readings/References Books/ Text Books

1. Introduction to Protein structure, 2nd Ed by Carl Branden and John Tooze, Garland Press,1999.
2. Structure and Mechanism in Protein Science, Alan Fersht, Freeman, 1999.
3. Protein engineering in Industrial biotechnology, Ed. Lilia Alberghina,

Harwood AcademicPublishers, 2002.

4. Proteins – Structures and Molecular Properties, 2nd Edition, Thomas E.

Creighton, W. H.Freeman and Company, New York.

5. Igor Jurisica, Dennis Wigle. Knowledge Discovery in Proteomics. 2006. Chapman & Hall

/ CRC Press.

6. Pennington SR (Ed), Dunn M. J. (Ed) Proteomics: from protein sequence to

function. 2002VivaBooks Pvt. Ltd.

7. Srivastava Sudhir (Ed). Informatics in Proteomics 2005 Taylor & Francis Group / CRC.

SYLLABUS STRUCTURE SHEET

RECOMBINANT DNA TECHNOLOGY

University: MGM University, CHH. SAMBHAJINAGAR	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree:** M.Sc. Plant Biotechnology
Course Unit Code: MPMML111	**Course Unit Title: Recombinant DNA Technology**
Credits allocated:3+0(Theory)	**Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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. Candidates should pass in undergraduate Life Science.

Course Description The course covers main approaches to design and analysis of algorithms including important algorithms and data structures, and results in complexity and computability. The main contentsare: review of algorithm analysis (search in ordered array)

Course Objectives

1. Describe, illustrate and apply different techniques in the fields of genomics and transcriptomics
2. Describe, illustrate and apply different techniques used for high-throughput molecular biology studies
3. Report orally and in writing within the subject
4. Review and give constructive feedback on the reports within the subject
5. Explain the theory of state-of-the-art tools/algorithms for processing data from high-throughput molecular biology experiments

Course Outcomes

At the end of the course, students will be able to.

Discuss the process of cloning and expression of gene and other techniques in genetic engineering &Biotechnology Perform DNA extraction from bacterial cell and estimation of purity. Perform PCR assays and DNAmanipulations techniques. Explain the application of modern biotechnological tools in cutting-edge research

COURSE CONTENT: UNIT-WISE SYLLABUSTHEORY

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.NicholII 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.

Bioinformatics and Functional Genomics

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Plant Biotechnology

Institute: Institute of Biosciences and Technology **Degree:** M.Sc. Plant Biotechnology

Course Unit Code:MPMML112 **Course Unit Title:** Bioinformatics and Functional Genomics

Credits allocated: 3+0 (3Th+0 Pr) **Level of Study:** PG

Mode of delivery, planned learning, and teaching method: Lecture: 3 hr weekly

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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. Candidate should have passed in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive exposure to the knowledge of plant genomes, methods of sequencing, genome assembly, and how to annotate the genome for functional analysis.

Objective: After the end of this course, students will be able to:

Comprehend the fundamental concepts of genome, tools and techniques of genome sequencing and genome annotation.

COURSE CONTENT: UNIT-WISE SYLLABUS
THEORY

Unit 1: Introduction to Genome (8 Lectures)

What is genome? Importance of genome; various genome marker-application of genome in different aspects of analysis; Human genome project; Genome Mapping – Genetic linkage map and Physical linkage map.

Unit 2: Sequencing Approach (9 Lectures)

Genome sequencing- Shotgun sequencing approach and Hierarchical sequencing approach, Sanger-Maximum gilbert; Roche450; Pyrosequencing; SOLID; Iontorrent; nanopore; illumine-pac-Bio.

Unit 3: Genome Assembly (9 Lectures)

What is assembly- different file format in assembly (fasta, fastq, sam, bam, bed), Quality assessment (fastqc, ngsqc), removal of adapter contamination (cutadapt, trimomatic); types of genome assembly (denovo, reference guided, hybrid); Contigs.

Unit 4: Genome Annotation (10 Lectures)

What is annotation, gene prediction; ORF prediction; gene structure, Identification of coding region; Biochemical function, Biological function, Expression analysis; Gene Ontology; Databases: BRENDA, KEGG.

Unit 5: Functional Genomics (9 Lectures)

Structural and Functional Genomics; Comparative Genomics, Whole genome alignment, Gene order comparison, EST, SAGE; DNA Microarray.

SUGGESTED READINGS/ REFERENCE BOOKS/ TEXT BOOKS

1. Introduction to Bioinformatics (Atwood, T.K. and Parry – Smith, D.J.)
2. Bioinformatics and functional genomics by Pevzner J, 2nd edition , Wiley
3. Bioinformatics; Methods and applications; Genomics , Proteomics and DrugDiscovery,(Rastogi ; S. C. and Mendiratta and Rastogi, P.)
4. Genomes 3- by Brown T. A.
5. Discovering Genomics, Proteomics and Bionformatics: by Campbell

Natural Products from Plants

University: MGM University, CHH. SAMBHAJINAGAR

Faculty: Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree: M.**Sc. Plant Biotechnology

Course Unit Code: MPMML113 **Course Unit Title:** Natural Products from Plants

Credits allocated: 3 (3 Th+0 Pr) **Level of Study:** PG

Mode of delivery, planned learning, and teaching method: Lecture: 3 hr weekly

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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. Candidate should have passed in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive exposure to the knowledge of Phytochemicals, How and Why These Compounds Are Synthesized by Plants, Molecular Biology of Plant Natural Products, traditional and modern methods Plant Biotechnology for the Production of Natural Products.

Objective: After the end of this course, students will be able to:
Comprehend the fundamental concepts natural products of plants and their traditional, advanced applications.

COURSE CONTENT: UNIT-WISE SYLLABUS
THEORY

Unit 1: Phytochemicals (10 Lectures)

Phytochemicals: The Chemical Components of Plants, How and Why These Compounds Are Synthesized by Plants, Regulation of Metabolite Synthesis in Plants, Plant Natural Products in the Rhizosphere.

Unit 2: Molecular Biology of Plant Natural Products (12 Lectures)

Molecular Biology of Plant Natural Products, The Study of Plant Natural Product Biosynthesis in the Pregenomics and Genomics Eras, Plant Biotechnology for the Production of Natural Products.

Unit 3: Traditional Analytical (12 Lectures)

Traditional, Analytical, and Preparative Separations of Natural Products, Characterization of Natural Products, Bioassays for Activity, Modes of Action at Target Sites, The Uses of Plant Natural Products by Humans and Risks Associated with Their Use.

Unit 4: People-Plant Relationship (11 Lectures)

The Synergy Principle at Work with Plants, Pathogens, Insects, Herbivores, and Humans, Plant Conservation, Relationship between People and Plants.

Suggested Readings / Reference Books/ Textbooks

1: Natural Products from Plants Second Edition by Leland J. Cseke Ara Kirakosyan Peter B. Kaufman Sara L. Warber James A. Duke Harry L. Brielmann.

Biomolecular Technologies (Practical)

University: MGM University, CHH. SAMBHAJINAGAR

Faculty: Basic &Applied Science

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMEP114 **Course Title:** Biomolecular Technologies (Practical)

Credits allocated: 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/Semester-II

Prerequisites for registration: Registration of a student in various courses in consultation withthe respective course teacher and adviser and acceptance by the principal. The approved coursesmust be mentioned in the roster form. Candidate should have passed in Under Graduate Life Sciences.

Course content

Biomolecular Technologies Practicals

1. Functioning and calibration of pH meter.
2. Demonstration of effect of pH and temperature on enzyme activity
3. Preparation of buffers and determination of isoelectric point
4. Extraction and purification of protein from plant and animals.
5. Spectrophotometric/ colorimetric estimation of proteins.
6. Visualization of chromatographic separation of protein
7. Preparation of competent cells and its transformation
8. Quantitative estimation of Vit C and Vit E.

Plant Biochemistry and Biotechnology Lab (Practical)

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic &Applied Science

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMEP114 **Course Title:** Plant Biochemistry and Biotechnology Lab (Practical)**Credits allocated:** 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/Semester-II

Prerequisites for registration: Registration of a student in various courses in consultation withthe respective course teacher and adviser and acceptance by the principal. The approved coursesmust be mentioned in the roster form. Candidate should have passed in Under Graduate Life Sciences.

Course content

Practicals

1. Preparation of standard solutions and reagents.
2. Carbohydrates – qualitative reaction, estimation of starch, reducing and non-reducing sugars; reaction of proteins, estimation of proteins by Biuret method.
3. Estimation of free fatty acids; determination of iodine number of vegetable oils. Vitamins – estimation of ascorbic acid. Paper and thin layer chromatography. Sterilization techniques – composition and preparation of media – micropropagation of tomato. Callus culture, sub-culturing, induction of rooting-techniques in hardening.

Culture Laboratory (Practical)

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic & AppliedScience

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMEP115 **Course Title:** Culture Laboratory (P)

Credits allocated: 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 have passed in Under Graduate Life Sciences.

Course content

Culture Laboratory Practicals

1. Selected techniques in light microscopy, Microtomy
2. Dissection and sectioning, permanent slides
3. Staining starch, cell wall, lipids, proteins
4. Study of induced aberrations in onion root tips employing chemical and plant extracts
5. Estimation of Photosynthetic pigments from the plant leaf
6. Sterilization of explants and inoculation
7. Media Preparation and Suspension culture
8. Isolation and identification of Rhizobium and Azospirillum
9. Isolation of P-solubilizing microbes

Computational & System Biology Lab (Practical)

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic & AppliedScience

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMEP115 **Course Title:** Computational & System Biology Lab (P)

Credits allocated: 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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 have passed in Under Graduate Life Sciences.

COURSE CONTENT

Practical

i. Usage of softwares for above topics
ii. . Molecular Visualization tools: RasMol, QMol, Swiss PDB, Pymol
iii. Biomolecular Interaction Databases: BIND, DIP;
iv. Structure Similarity Search Tools: CN3D, Vast Search

MICRO PROJECT

University: MGM University, CHH. SAMBHAJINAGAR **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences & Technology **Degree:** M.Sc. Plant Biotechnology

Course Code: MPMMJ118 **Course Title:** Micro project

Credits allocated: 2 (0 Th + 2 Pr) **Level of Study:** PG

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

Recommended Year/Semester: M.Sc. Plant Biotechnology/First year/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. Candidate should have passed in Under Graduate Life Sciences.

Learning Outcomes: This course is designed to provide students with comprehensive exposure to project work.

Objective: After the end of this course, students will be able to understand the concepts of project work based on their idea, design of objective, methodology, and execution of project work, writingsynopsis and interpreting the results.

Course content

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 fieldbefore 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 agoodsolution.

2. Evaluation:

Clearly relates to the problem. Shows a good understanding and appreciation of the solution.Objectivesof 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 area of expertise (ot 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 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,	Project head

	plagiarism, poor presentation, genuiene absentees.	
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 have failed in the project work and shall re – enroll for the same	Project head Project guide Director

FIELD PROJECT

University: MGM University, CHH. SAMBHAJINAGAR	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** Plant Biotechnology
Course Code: MPFPJ119	**Course Title:** Field Project
Credits allocated: 0+4 (Practical)	Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Practical 4 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. Candidates should pass in undergraduate Life Science.

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 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.

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:

1. Use the data analysis tools for findings
2. The individual and group activity (2-3 times discussion with project-coordinator) student's effort and commitment.
3. The quality of the work produced by the individual student.
4. The student's integration and co-operation with the rest of the group.
5. The completeness of the logbook & time to time signature of guide