



**MGM UNIVERSITY, AURANGABAD**  
**INSTITUTE OF BIOSCIENCES AND TECHNOLOGY**

**SEMESTER PATTERN**

Faculty of Sciences

Post Graduate (PG) programme

**PLANT BIOTECHNOLOGY - CURRICULUM**

w. e. f. Academic Year 2021-22

M.Sc. Plant Biotechnology

**M.Sc. PLANT BIOTECHNOLOGY (PBT)**  
**Program Layout**

<b>M.Sc. Plant Biotechnology</b>																		
<b>Semester I</b>																		
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing						Credit
						Internal			External			Total	Internal			External		
			(Mandatory)	L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	TW	ESE	PR	
MPT-111	Plant cell, Tissue and organ culture	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-112	Biochemistry	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-113	Molecular Cell Biology	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-114	Plant Physiology and Development	Theory	4			20	20		60		100	-	-	-	24	-	40	4
PTL-115	Plant Science Lab (Practical)	Practical			4			40		60	100	-	-	16		24	40	2
PTL-116	Plant Lab (Practical)	Practical			2			20		30	50	-	-	8		12	20	1
PTL-117	Mini Project	Practical			4			40		60	100	-	-	16		24	40	2
PTL-118	Seminar	Practical			1			20		30	50	-	-	8		12	20	1
PTL-119	Open Elective Course	Practical			1			20		30	50	-	-	8		12	20	1
	<b>Total</b>		16		12	80	80	140	240	210	750	0	0	56	96	84	300	23

Semester II																		
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing					Credit	
						Internal			External			Total	Internal			External		Total
			(Mandatory)	L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	TW	ESE		
MPT-121	Protein Engineering for Industrial Plant Biotech	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-122	Gene Technology, synthetic Biology, Genome Editing and Engineering	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-123	Bioinformatics and Functional Genomics	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-124	Natural Products from Plants	Theory	4			20	20		60		100	-	-	-	24	-	40	3
PTL-125	Biomolecular Technologies (Practical)	Practical			6			40		60	100	-	-	16		24	40	3
PTL-126	Culture Laboratory (Practical)	Practical			2			20		30	50	-	-	8		12	20	1
PTL-127	Micro Project	Practical			4			40		60	100	-	-	16		24	40	2
PTL-128	Seminar	Practical			1			20		30	50	-	-	8		12	20	1
PTL-129	Open Elective Course	Practical			1			20		30	50	-	-	8		12	20	1
	<b>Total</b>		16		14	80	80	140	240	210	750	0	0	56	96	84	300	23

Semester III																		
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing					Credit	
						Internal			External			Total	Internal			External		Total
			(Mandatory)	L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	TW	ESE		
MPT-231	Target Traits for Crop Improvement	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-232	molecular Breeding	Theory	4			20	20		60		100	-	-	-	24	-	40	4
PTL-233	Techniques in Molecular Biology (Practical)	Practical			8			40		60	100	-	-	16		24	40	4
PTL-234	Major Project	Practical			8			80		120	200	-	-	32		48	80	4
PTL-235	Seminar	Practical			2			40		60	100	-	-	16		24	40	2
PTL-236	Blended Course	Practical			2			40		60	100	-	-	16		24	40	2
	<b>Total</b>		8		20	40	40	200	120	300	700	0	0	80	48	120	280	20

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

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

**(M.Sc. Plant Biotechnology)**  
**Semester wise Layout**

<b>Semester I</b>																				
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing						Credit		
						Internal			External			Total	Internal			External			Total	
						CA	MSE	T W	ESE	PR	CA		MSE	TW	ESE	PR				
<b>(Mandatory)</b>			L	T	P	CA	MSE	T W	ESE	PR	Total	CA	MSE	TW	ESE	PR	Total			
MPT-111	Plant cell, Tissue and organ culture	Theory	4			20	20		60		100	-	-	-	24	-	40	4		
MPT-112	Biochemistry	Theory	4			20	20		60		100	-	-	-	24	-	40	4		
MPT-113	Molecular Cell Biology	Theory	4			20	20		60		100	-	-	-	24	-	40	4		
MPT-114	Plant Physiology and Development	Theory	4			20	20		60		100	-	-	-	24	-	40	4		
PTL-115	Plant Science Lab (Practical)	Practical			4			40		60	100	-	-	16		24	40	2		
PTL-116	Plant Lab (Practical)	Practical			2			20		30	50	-	-	8		12	20	1		
PTL-117	Mini Project	Practical			4			40		60	100	-	-	16		24	40	2		
PTL-118	Seminar	Practical			1			20		30	50	-	-	8		12	20	1		
PTL-119	Open Elective Course	Practical			1			20		30	50	-	-	8		12	20	1		
	<b>Total</b>		16		12	80	80	140	240	210	750	0	0	56	96	84	300	23		

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

### Subject-wise course details

<b>University:</b> MGM University, Aurangabad	<b>Faculty:</b> Basic and Applied Sciences
<b>Institute:</b> Institute of Biosciences & Technology	<b>Degree:</b> M.Sc. Plant Biotechnology (PG)
<b>Course Code:</b> MPT-111	<b>Course Title:</b> Plant cell, Tissue, and Organ culture
<b>Credits allocated:</b> 4+0 (4 Th+ 0 Pr)	<b>Level of Study:</b> Post-Graduate (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 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

**Course Code:** MPT-111

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

#### Unit 1: Basics of plant tissue culture

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**

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**

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**

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**



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-Michel Mérillon 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.

### **Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

### **Internal Assessment (Marks distribution): 40**

#### **1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

## 2: Home Assignment:

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

## 3: Attendance

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

## **BIOCHEMISTRY**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences and Tech.

**Degree:** Plant Biotechnology (PG)

**Course Unit Code:** MPT-112

**Course Unit Title:** Biochemistry

**Credits allocated:** 4 (4 Th+ 0 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 of biochemistry, Structures & Functions of Proteins & Enzymes, Bioenergetics & The Metabolism of Carbohydrates & Lipids, Structure, Function & Replication of Informational Macromolecules and cellular communication system.

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

Comprehend the fundamental concepts of biochemistry. Structures & Functions and metabolism of biomolecules, cellular communication system.

## **BIOCHEMISTRY**

### **COURSE CONTENTS**

#### **Theory**

**Course Code:** MPT-112

**Course Title:** Biochemistry

#### **Unit 1: Structures & Functions of Proteins & Enzymes**

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

### **Unit 2: 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 3: Metabolism of Proteins & Amino Acids**

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 4: Structure, Function & Replication of Informational Macromolecules**

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 5: Biochemistry of Extracellular & Intracellular Communication**

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

### **SUGGESTED READINGS / REFERENCE BOOKS/ TEXTBOOKS**

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<sup>th</sup> 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<sup>th</sup> edition Mc Graw-Hill.
8. Aneja, K.R., Jain, P. and Aneja, R (2008) Textbook of Basic and Applied Microbiology New Age International.

**Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

**Internal Assessment (Marks distribution): 40**

**1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

## 2: Home Assignment:

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

## 3: Attendance

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

## MOLECULAR CELL BIOLOGY

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences and Tech.

**Degree:** Plant Biotechnology (PG)

**Course Unit Code:** MPT-113

**Course Unit Title:** Molecular Cell  
Biology

**Credits allocated:** 4 (4 Th+0 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 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 CONTENTS**

### **THEORY**

**Course Unit Code:** MPT-113

**Course Unit Title:** Molecular Cell

Biology

#### **Unit 1: The Genetic Material and Information**

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

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

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

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

**Weak & Strong Bonds Determine Macromolecular structure:** Higher-order structures are determined by intra and intermolecular interactions, specific confirmation of protein results from its pattern of Hydrogen Bonds, most proteins are Modular, containing two or three

Domains, Weak Bonds Correctly position proteins along DNA & RNA Molecules, Allostery: Regulation of a proteins function by changing its shape.

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

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

## **Unit 2: DNA Replication, Recombination, and Repair**

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

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

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

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

## **Unit 3: Gene Expression and RNA Splicing**

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

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

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

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



#### **Unit 4: Gene Regulation and Genomics**

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

Gene Regulation in Eukaryotes: Conserved Mechanisms of Transcriptional Regulation from Yeast to Mammals, Recruitment of Protein Complexes to Genes by Eukaryotic Activators, Signal Integration & Combinatorial Control, Transcriptional Repressors Signal Transduction & the Control of Transcriptional Regulators, Gene silencing by Modification of Histones & DNA, Eukaryotic Gene Regulation at steps after transcription initiation, RNAs in Gene Regulation.

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

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

#### **Unit 5: Techniques of Molecular Biology**

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

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

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

**Pathogens and Infection:** introduction to pathogens and the human microbiota, cell biology of infection.

#### **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. Freeman and Company, 2003. ISBN: 9780716743668.
3. Hardin, J, and Bertoni, G.P. 2015. Becker's World of the Cell, 9th edition, Pearson
4. Bruce Alberts, et al. Molecular biology of the cell. Garland Science, 2015. 6th edition.
5. Alberts, Bray, Hopkin, Johnson, Lewis, Raff, Roberts, and Walter. 2014. Essential Cell Biology 4th ed. Garland Science. ISBN: 978-0-8153-4454-4.

**Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

**Internal Assessment (Marks distribution): 40**

**1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

## 2: Home Assignment:

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

## 3: Attendance

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

## Plant Physiology & Development

**University:** MGM University, Aurangabad

**Faculty:** Plant Biotechnology

**Institute:** Institute of Biosciences and Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Unit Code:** MPT-114

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

**Credits allocated:** 4+0 (4 Th+0 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 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 CONTENTS**

### **THEORY**

**Course Unit Code:** MPT-114

**Course Unit Title:** Plant Physiology & Development

#### **Unit 1: Cell and Water**

Plant and Cell Architecture: Plant Life Processes: Unifying Principles, Plant Classification and Life Cycles, Overview of Plant Structure, Plant Cell Organelles, The Endomembrane System, Independently Dividing or Fusing Organelles Derived from the Endomembrane System, Independently Dividing, Semiautonomous Organelles, The Plant Cytoskeleton, Cell Cycle Regulation, Plant Cell Types, Nuclear Genome Organization, Nuclear Genome Organization, Plant Cytoplasmic Genomes: Mitochondria and Plastids, Transcriptional Regulation of Nuclear Gene Expression, Posttranscriptional Regulation of Nuclear Gene Expression, Tools for Studying Gene Function, Genetic Modification of Crop Plants, Water in Plant Life, The Structure and Properties of Water, Diffusion and Osmosis, Water Potential, Water Potential of Plant Cells, Cell Wall and Membrane Properties, Plant Water Status, Water in the Soil, Water Absorption by Roots, Water Transport through the Xylem, Water Movement from the Leaf to the Atmosphere.

#### **Unit 2: Biochemistry and Metabolism**

Photosynthesis: The Light Reactions: Photosynthesis in Higher Plants, General Concepts, Key Experiments in Understanding Photosynthesis, Organization of the Photosynthetic Apparatus, Organization of Light-Absorbing Antenna Systems, Mechanisms of Electron Transport, Proton Transport and ATP Synthesis in the Chloroplast, Repair and Regulation of the Photosynthetic Machinery, Genetics, Assembly, and Evolution of Photosynthetic Systems, Photosynthesis: The Carbon Reactions, The Calvin–Benson Cycle, The C<sub>2</sub> Oxidative Photosynthetic Carbon Cycle, Inorganic Carbon–Concentrating Mechanisms,

Inorganic Carbon-Concentrating Mechanisms: The C<sub>4</sub> Carbon Cycle, Inorganic Carbon-Concentrating Mechanisms: Crassulacean Acid Metabolism (CAM), Accumulation and Partitioning of Photosynthates—Starch and Sucrose, Formation and Mobilization of Chloroplast Starch, Sucrose Biosynthesis and Signalling, Photosynthesis: Physiological and Ecological Considerations, Photosynthesis Is Influenced by Leaf Properties, Effects of Light on Photosynthesis in the Intact Leaf, Effects of Temperature on Photosynthesis in the Intact Leaf, Effects of Carbon Dioxide on Photosynthesis in the Intact Leaf, Stable Isotopes Record Photosynthetic Properties.

### **UNIT 3: Stomatal Nutrition**

Light-dependent Stomatal Opening. Mediation of Blue-light Photoreception in Guard Cells by Zeaxanthin. Reversal of Blue Light-Stimulated Opening by Green Light. The Resolving Power of Photo physiology. Translocation in the Phloem. Pathways of Translocation. Patterns of Translocation: Source to Sink Materials Translocated in the Phloem. Rates of Movement. The Pressure-Flow Model, a Passive Mechanism for Phloem Transport. Phloem Loading. Phloem Unloading and Sink-to-Source Transition. Photosynthate Distribution: Allocation and Partitioning. Transport of Signalling Molecules. Respiration and Lipid Metabolism. Overview of Plant Respiration. Glycolysis. The Oxidative Pentose Phosphate Pathway. The Citric Acid Cycle. Mitochondrial Electron Transport and ATP Synthesis. Respiration in Intact Plants and Tissues. Lipid Metabolism. Assimilation of Inorganic Nutrients. Nitrogen in the Environment. Nitrate Assimilation. Ammonium Assimilation. Amino Acid Biosynthesis, Biological Nitrogen Fixation.

### **UNIT 4: Growth and Development**

Cell Walls: Structure, Formation, and Expansion. Overview of Plant Cell Wall Functions and Structures. Primary Cell Wall Structure and Function. Mechanisms of Cell Expansion. The Extent and Rate of Cell Growth. Secondary Cell Wall Structure and Function. Signals and Signal Transduction. Temporal and Spatial Aspects of Signalling. Signal Perception and Amplification. Hormones and Plant Development. Phytohormone Metabolism and Homeostasis. Signal Transmission and Cell-Cell Communication. Hormonal Signalling Pathways. Signals from Sunlight. Plant Photoreceptors. Phytochromes. Phytochrome Responses. Phytochrome Signalling Pathways. Blue-Light Responses and Photoreceptors. Cryptochromes. The Coaction of Cryptochrome, Phytochrome, and Phototropins. Phototropins. Responses to Ultraviolet Radiation. Overview of Plant Growth and

Development. Embryogenesis: The Origins of Polarity. Meristematic Tissues: Foundations for Indeterminate Growth. The Root Apical Meristem. The Shoot Apical Meristem. The Vascular Cambium. Seed Dormancy, Germination, and Seedling Establishment. Seed Structure. Seed Dormancy. Release from Dormancy. Seed Germination. Mobilization of Stored Reserves. Seedling Growth and Establishment. Tropisms: Growth in Response to Directional Stimuli. Phototropism. Photomorphogenesis.

### **Unit 5: Flowering and Stress**

The Control of Flowering and Floral Development, Floral Evocation: Integrating Environmental Cues, The Shoot Apex and Phase Changes, Circadian Rhythms: The Clock Within, Photoperiodism: Monitoring Day Length, Vernalization: Promoting Flowering with Cold, Long-Distance Signalling Involved in Flowering, The Identification of Florigen, Floral Meristems and Floral Organ Development, Gametophytes, Pollination, Seeds, and Fruits, Development of the Male and Female Gametophyte Generations, Formation of Male Gametophytes in the Stamen, Female Gametophyte Development in the Ovule, Pollination and Fertilization in Flowering Plants, Selfing versus Outcrossing, Apomixis: Asexual Reproduction by Seed, Endosperm Development, Seed Coat Development, Seed Maturation and Desiccation Tolerance, Fruit Development and Ripening, Plant Senescence and Cell Death, Programmed Cell Death and Autolysis, The Leaf Senescence Syndrome, Leaf Senescence: The Regulatory Network, Leaf Abscission, Whole Plant Senescence, Biotic Interactions, Beneficial Interactions between Plants and Microorganisms, Harmful Interactions between Plants, Pathogens, and Herbivores, Inducible Defense Responses to Insect Herbivores, Plant Defenses against Pathogens.

### **SUGGESTED READINGS/ REFERENCE BOOKS/ TEXT BOOKS**

1. Plant Physiology and Development, Lincoln Taiz, Eduardo Zeiger, Ian Max Møller, Angus Murphy.
2. Plant Physiology, Philip Stewart, PhD and Sabine Globig.
3. Plant Physiology Theory and Applications, S. L. Kochhar, Sukhbir Kaur Gujral.

### **Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

### **Internal Assessment (Marks distribution): 40**

#### **1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

#### **2: Home Assignment:**

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

#### **3: Attendance**

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

### **Plant Science Lab (Practical)**

**University:** MGM University, Aurangabad      **Faculty:** Basic & Applied Science  
**Institute:** Institute of Biosciences & Technology      **Degree:** M.Sc. Plant Biotechnology  
**Course Code:** PTL-115      **Course Title:** Plant Science Lab (P)  
**Credits allocated:** 4 (0 Th + 4 Pr)      **Level of Study:** PG

**Mode of delivery, planned learning, and teaching method:** Lecture: 6 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 **course content missing**

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

Comprehend the fundamental concepts **course content missing**

### **Course content**

**Missing**

### **Practical Assessment**

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



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

#### The criteria for attendance

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

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

#### Plant Lab (Practical)

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-116

**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: 6 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.

Practical Assessment (Marks distribution):50

#### Practical Assessment

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

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

#### **The criteria of attendance**

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

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

### **MINI PROJECT**

#### **Plant Science Lab (Practical)**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-117

**Course Title:** Mini project

**Credits allocated:** 4 (0 Th + 4 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 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.

### Course content

Missing

#### Project Assessment (100 Marks)

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

#### Ideas of project:

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

#### Literature survey:

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

## Understanding of Subject:

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

### 1. Implementation:

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

### 2. Evaluation:

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

### 3. Project Log:

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

#### • Attendance:

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

The criteria of attendance

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

**Project External Assessment (Marks distribution): 60**

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

### SEMINAR

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-118

**Course Title:** Seminar

**Credits allocated:** 1 (0 Th + 2 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 for the development of presentation skills, students will aware of various tools for presentation.

**Objective:** After the end of this course, students will be able to: make their presentation, develop skill delivering presentation work

### SEMINAR ASSESSMENT (Marks distribution): 50

Seminar Topic	Understanding of Subject	Presentation	Attendance	Total Marks

05	05	05	05	20
External Assessment:				30
Total Marks				50

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

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

### **Open Elective Course**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-119

**Course Title:** Open Elective Course

**Credits allocated:** 2 (0 Th + 2 Pr)

**Level of Study:** PG

**Mode of delivery, planned learning, and teaching method:** Lecture: 1 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 supporting learning exposure along with their regular courses.

**Objective:** After the end of this course, students will be able to comprehend the fundamental concepts the course that they have chosen as per their interest.

## **SOP for Open elective Courses**

It is mandatory for undergraduate & post graduate students to undertake open elective courses for concern credits before the completion of the degree.

- Students have the option of choosing any open Elective courses under the category of mandatory elective courses.
- A student is not eligible for more than one open Elective course under the category of mandatory courses.
- For UG and PG programs the Open Electives are offered within the regular class hours.
- These courses generally earn concern credits consisting of 8 weeks-12 weeks during the completion of semester.
- Students can view the complete details of the courses offered Elective courses in their course layout.
- Till a student finishes OEC under the mandatory course category, he/she is eligible to apply for other open elective courses.
- Evaluation pattern is the discretion of the faculty concerned for UG & PG courses will be with only end semester examinations
- Examinations are conducted by the departments concerned and the results are indicated only in Grades in the marks card.
- Minimum pass percentage is 40% for courses under the mandatory category. Grades are awarded only if the student passes.
- These courses are conducted after or before the regular class hours and the courses offered are different in Odd and Even semesters.
- Students are advised to finalize their choice of programs in consultation with their OEC coordinator.
- Minimum prescribed attendance for these courses is 85%. **Medical and co-curricular claim will be considered only if the student put in 75% physical attendance or the classes.**



- Attendance claim shall be submitted to OEC coordinator within 07 days after availing the leave.
- Students who fail to secure the minimum pass marks or required minimum attendance or who discontinue in between the course are required to register afresh. Re-registration is permitted only in the subsequent semester which may be for the same course or any other courses from the choices available during the particular semester.
- He / She submit course syllabus weekly report on the basis of that OEC co-ordinator conduct their continuous assessment.
- A student is not eligible to graduate without completing OEC mandatory course.
- OEC offered by departments like Performing Arts, Industrial Automation, Industry 4.0, Vastushastra, Sketching, Hotel Management, Film Making, Python programming, Theatre and Music etc.
- Each course admits only 40 students on a first-come-first-served basis. Courses that do not get the minimum required applications may not be conducted.
- The course platform for registration are SWAYAM NPTEL, Agmooc and Coursera.

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

### **Assessment of OEC (1 Credit: 50 Marks)**

#### **Internal Evaluation**

Internal Assessment	10Marks
Weekly Report Submission	10Marks

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

#### **External Evaluation**

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

Semester II																		
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing						Credit
						Internal			External			Total	Internal			External		
			(Mandatory)	L	T	P	CA	MSE	T W	ESE	PR		CA	MSE	TW	ESE	PR	
MPT-121	Protein Engineering for Industrial Plant Biotech	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-122	Gene Technology, synthetic Biology, Genome Editing and Engineering	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-123	Bioinformatics and Functional Genomics	Theory	4			20	20		60		100	-	-	-	24	-	40	4
MPT-124	Natural Products from Plants	Theory	4			20	20		60		100	-	-	-	24	-	40	3
PTL-125	Biomolecular Technologies (Practical)	Practical			6			40		60	100	-	-	16		24	40	3
PTL-126	Culture Laboratory (Practical)	Practical			2			20		30	50	-	-	8		12	20	1
PTL-127	Micro Project	Practical			4			40		60	100	-	-	16		24	40	2
PTL-128	Seminar	Practical			1			20		30	50	-	-	8		12	20	1
PTL-129	Open Elective Course	Practical			1			20		30	50	-	-	8		12	20	1
	<b>Total</b>		16		14	80	80	140	240	210	750	0	0	56	96	84	300	23

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

## Subject-wise course details

**University:** MGM University, Aurangabad

**Faculty:** Basic and Applied Sciences

**Institute:** Institute of Biosciences &  
Technology

**Degree:** M.Sc. Plant Biotechnology (PG)

**Course Code:** MPT-121

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

**Credits allocated:** 4+0 (4 Th+ 0 Pr)

**Level of Study:** Post-Graduate (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 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

### Protein Engineering for Industrial Plant Biotech

#### Theory

**Course code:** MTP-121

**Course title:** Protein Engineering for  
Industrial Plant Biotech

#### Unit 1: Biology of Protein and protein structure

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**

Protein folding and assembly Protein folding pathways in prokaryotes and eukaryotes; Single and 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**

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**

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**

Proteomics Technologies: Protein Arrays/ Protein Chips and their application, 2D Gel Electrophoresis and its application Mass Spectrometry and Protein Identification, Proteomics Databases 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 Academic Publishers, 2002.
4. Proteins – Structures and Molecular Properties, 2nd Edition, Thomas E. Creighton, W. H. Freeman and Company, New York.
5. Igor Jurisica, Dennis Wagle. Knowledge Discovery in Proteomics. 2006. Chapman & Hall / CRC Press.
6. Pennington SR (Ed), Dunn M. J. (Ed) Proteomics: from protein sequence to function. 2002 Viva Books Pvt. Ltd.
7. Srivastava Sudhir (Ed). Informatics in Proteomics 2005 Taylor & Francis Group / CRC.

**Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

**Internal Assessment (Marks distribution): 40**

**1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

## 2: Home Assignment:

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

## 3: Attendance

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

## Gene Technology, Synthetic Biology, Genome Editing and Engineering

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences and Tech.

**Degree:** Plant Biotechnology (PG)

**Course Unit Code:** MPT-122

**Course Unit Title:** Gene Technology, Synthetic Biology, Genome Editing and Engineering

**Credits allocated:** 4 (4Th+ 0 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 of Molecular Tools for Gene Cloning, Advanced Techniques in Molecular Biology, concept of synthetic biology, RNA Engineering and Cell-Biomaterial Engineering.

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

Comprehend the fundamental concepts Molecular Tools and techniques used for Gene Cloning, Advanced Techniques in Molecular Biology, will understand the concept of synthetic biology, RNA Engineering and Cell-Biomaterial Engineering.

## **COURSE CONTENTS**

### **Theory**

**Course Code: MPT-122**

**Course Title:** Gene Technology, Synthetic Biology,  
Genome Editing and Engineering

#### **Unit 1. Molecular Tools for Gene Cloning**

Nucleases: Exonucleases and Endonucleases, Restriction Enzymes (Type I, Type II, Type III, Type IV & Type V), RNases, Methylases: CpG Methylase, Dam Methylase, Dcm Methylase  
Polymerases: DNA Pol I, Klenow Fragments, Reverse Transcriptase, Taq & Pfu Polymerases  
Ligases: T4 DNA Ligase, E.coli DNA Ligase, T4 RNA Ligase, Topoisomerases: Type I(A, B) & Type II(A,B), End Modifying Enzymes: Terminal Transferase, T4 Polynucleotide Kinase, Alkaline Phosphatases, Introduction to cloning vectors, Desirable properties of vectors, Prokaryotic & Eukaryotic Expression Systems (Constitutive & Inducible), Plasmid Vectors, Phage Vectors, Cosmids, Phagemids, BACs, Yeast Vectors, YACs, Lentiviral Vectors, Adenoviral Vectors, Plant Vectors, Insect Vectors.

#### **Unit 2. Advanced Techniques in Molecular Biology**

Polymerase Chain Reaction, Quantitative Real-Time PCR, Gel Electrophoresis: AGE & PAGE, Blotting Techniques: Southern, Western & Northern Methods of gene transfer in Plants and Animals: Chemical, Physical & Viral mediated DNA transfer, Construction of Genomic & cDNA Libraries, DNA Sequencing, Protein Engineering: Site-Directed Mutagenesis, Reporter Gene Assays, DNA Protein Interactions: EMSA, DNA Foot-printing, Protein-Protein Interactions: Y2H, Y3H, B1H, B2H, recent trends in molecular biology



research, Targeted Genome Editing: ZFNs, TALENs, CRISPRs, Gene Targeting: Knock-ins & Knock-outs, DNA Finger Printing

### **Unit 3. Synthetic Biology-1**

Expression and regulation in prokaryotic and eukaryotic systems including their viruses. Advanced biotechnological methods comprising cloning, mutagenesis, polymerase chain reaction, synthesis of nucleic acids, DNA sequence determination, synthetic genomics, CRISPR- Cas9, directed evolution, alternative splicing and computational modeling. Experimental characterization of structural and functional properties of biomolecules. Bioinformatic analysis and characterization of genes and biomolecules. Basic theoretical and computational modeling of replicating systems. Laboratory highlighting BioBrick cloning and chromoprotein reporters as a methodology in synthetic biology. Ethical aspects.

### **Unit 4: Synthetic Biology-2**

Noise in gene expression: Origin, propagation, consequences, and control, Robustness and evolvability of genetic networks, Bacterial circuits: Toggle switch and repressilator Instructor out of town, Bacterial circuits: Feedback, feed-forward, signal propagators, and band filter, Bacterial communication circuits: Population control and patterning systems, Bacterial communication circuits: Synchronized oscillators, Functional synthetic systems: From modules to systems, Gene circuit design and engineering: Biobricks/BioFAB and designing software, Synthetic circuits beyond bacteria: Phage, virus, and eukaryotic

### **Unit 5: RNA Engineering and Cell-Biomaterial Engineering**

Introduction Amplify aptamer-encoding DNA, SELEX I: Building a Library-Purify aptamer-encoding DNA, SELEX II: Selecting RNA with target functionality-Prepare RNA by IVT, SELEX III: Technical advances & problem-solving--Purify RNA and run affinity column, Characterizing aptamers--RNA to DNA by RT-PCR, Introduction to porphyrins: chemistry & biology--, Aptamer applications in biology & technology--Aptamer binding assay, Aptamers as therapeutics Introduction--Start-up biomaterials engineering, Introduction to biomaterials; cartilage composition--Initiate cell culture, Basic statistics; standards in scientific communities I--Testing cell viability, Standards in scientific communities II; cell viability--Preparing cells for analysis, Assays for transcription and protein levels-- Transcript-level analysis, Cartilage TE: from in vitro and in vivo models to the clinic-- Protein-level analysis, Creating your proposal presentation-Wrap-up analysis, Drug and gene delivery; clinical progress in engineering tissues besides cartilage--presentations

## **SUGGESTED READINGS / REFERENCE BOOKS/ TEXTBOOKS**

1. Principles of Gene Manipulation and Genomics, 7<sup>th</sup> Edition – Sandy B. Primrose, Richard Twyman – Blackwell Publishing
2. Gene Cloning and DNA Analysis: An Introduction, 6th Edition - T. A. Brown - John Wiley & Sons.
3. An Introduction to Genetic Engineering, 3rd Edition - Desmond S. T. Nicholl - Cambridge University Press.
4. Molecular Biotechnology: Principles and Applications of Recombinant DNA (link is external)- 4th Edition - Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten - ASM Press
5. Synthetic Biology: Tools and Application by Huimin Zhao.
6. Bioengineering: A conceptual approach by Mirjana Pavlovic.
7. Synthetic biology: a lab manual by Liljeruhm, Josefine; Gullberg, Erik; Forster, Anthony C.
8. Uri Alon, An Introduction to Systems Biology: Design Principles of Biological Circuits, Chapman & Hall/CRC (2006).
9. Eric Davidson, The Regulatory Genome: Gene Regulatory Networks In Development And Evolution, Academic Press (2006).
10. Hamid Bolouri, Computational Modeling Of Gene Regulatory Networks - A Primer, Imperial College Press (1st edition) (2008).
11. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter, Molecular Biology of the Cell, Garland Science (4th edition) (2002).
12. Robert Brooks Phillips, Jane Kondev and Julie Theriot, Physical Biology of the Cell, Garland Science (1st edition) (2008).
13. Mark Ptashne and Alexander Gann, Genes and Signals, Cold Spring Harbor Laboratory Press (1st edition) (2001).

### **Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

### **Internal Assessment (Marks distribution): 40**

#### **1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

#### **2: Home Assignment:**

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

#### **3: Attendance**

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

Sr. No	Percentage of attendance	Marks
1.	70-80	7-8
2.	80-90	8-9

3.	90-100	9-10
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### **Bioinformatics and Functional Genomics**

**University:** MGM University, Aurangabad      **Faculty:** Plant Biotechnology  
**Institute:** Institute of Biosciences and Technology      **Degree:** M.Sc. Plant Biotechnology  
**Course Unit Code:** MPT-123      **Course Unit Title:** Bioinformatics and  
Functional Genomics  
**Credits allocated:** 4+0 (4Th+0 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 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 CONTENTS**

#### **THEORY**

**Course Unit Code:** MPT-123      **Course Unit Title:** Bioinformatics and  
Functional Genomics

### **Unit 1: Introduction to Genome**

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**

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

### **Unit 3: Genome Assembly**

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**

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**

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 Drug Discovery, (Rastogi ; S. C. and Mendiratta and Rastogi, P.)
4. Genomes 3- by Brown T. A.
5. Discovering Genomics, Proteomics and Bionformatics: by Campbell

**Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

**Internal Assessment (Marks distribution): 40****1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

**2: Home Assignment:**

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

**3: Attendance**

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

### **Natural Products from Plants**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences and Tech.

**Degree:** Plant Biotechnology (PG)

**Course Unit Code:** MPT-124

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

**Credits allocated:** 4 (4 Th+0 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 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.

### **Natural Products from Plants**

#### **THEORY**

**Course Unit Code:** MPT-124

**Course Unit Title:** Natural Products

from Plants

### **Unit 1: Phytochemicals**

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**

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

### **Unit 3: Traditional Analytical**

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**

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

### **Unit 5: MISSING**

## **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.

### **Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.



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

### **Internal Assessment (Marks distribution): 40**

#### **1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

#### **2: Home Assignment:**

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

#### **3: Attendance**

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

Sr. No	Percentage of attendance	Marks
1.	70-80	7-8
2.	80-90	8-9

3.	90-100	9-10
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### **Biomolecular Technologies (Practical)**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-125

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

**Credits allocated:** 3 (0 Th + 3 Pr)

**Level of Study:** PG

**Mode of delivery, planned learning, and teaching method:** Lecture: 6 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 **course content is missing**

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

Comprehend the fundamental concepts of **course content is missing**

### **Course content**

**Missing**

### **Practical Assessment**

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

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

The criteria for attendance

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

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

### **Culture Laboratory (Practical)**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-126

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

**Credits allocated:** 1 (0 Th + 1 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 **course content is missing**

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

Comprehend the fundamental concepts of **course content is missing**

### Course content

**Missing**

### Practical Assessment (Marks distribution):50

#### Practical Assessment

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

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

#### The criteria of attendance

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

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

### **MICRO PROJECT**

**University:** MGM University, Aurangabad      **Faculty:** Basic & Applied Science  
**Institute:** Institute of Biosciences & Technology      **Degree:** M.Sc. Plant Biotechnology  
**Course Code:** PTL-127      **Course Title:** Micro project  
**Credits allocated:** 2 (0 Th + 2 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 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.

### **Course content**

Missing

**Project Assessment (100 Marks)**

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

### **Ideas of project:**

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

### **Literature survey:**

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

### **Understanding of Subject:**

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

#### **1. Implementation:**

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

## 2. Evaluation:

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

## 3. Project Log:

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

- **Attendance:**

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

The criteria of attendance

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

## Project External Assessment (Marks distribution): 60

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

### Seminar

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-128

**Course Title:** Seminar

**Credits allocated:** 1 (0 Th + 2 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 for the development of presentation skills, students will aware of various tools for presentation.

**Objective:** After the end of this course, students will be able to: make their presentation, develop skill delivering presentation work

#### SEMINAR ASSESMENT (Marks distribution): 50

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

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

Sr. No	Percentage of attendance	Marks
5.	70	2



6.	80	3
7.	90	4
8.	100	5

### **Open Elective Course**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-129

**Course Title:** Open Elective Course

**Credits allocated:** 1 (0 Th + 1 Pr)

**Level of Study:** PG

**Mode of delivery, planned learning, and teaching method:** Lecture: 1 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 supporting learning exposure along with their regular courses.

**Objective:** After the end of this course, students will be able to comprehend the fundamental concepts the course that they have chosen as per their interest.

### **SOP for Open elective Courses**

It is mandatory for undergraduate & post graduate students to undertake open elective courses for concern credits before the completion of the degree.

- Students have the option of choosing any open Elective courses under the category of mandatory elective courses.
- A student is not eligible for more than one open Elective course under the category of mandatory courses.
- For UG and PG programs the Open Electives are offered within the regular class hours.

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

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

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

**Internal Evaluation**

Internal Assessment	10Marks
Weekly Report Submission	10Marks

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

**External Evaluation**

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

Semester III																				
Course code*	Course Title	Type	Teaching Scheme			Evaluation Scheme						Minimum Passing						Credit		
						Internal			External			Total	Internal			External			Total	
						CA	MSE	T W	ESE	PR	CA		MSE	TW	ESE	PR				
(Mandatory)			L	T	P	CA	MSE	T W	ESE	PR	Total	CA	MSE	TW	ESE	PR	Total			
MPT-231	Target Traits for Crop Improvement	Theory	4			20	20		60		100	-	-	-	24	-	40	4		
MPT-232	Molecular Breeding	Theory	4			20	20		60		100	-	-	-	24	-	40	4		
PTL-233	Techniques in Molecular Biology (Practical)	Practical			8			40		60	100	-	-	16		24	40	4		
PTL-234	Major Project	Practical			8			80		120	200	-	-	32		48	80	4		
PTL-235	Seminar	Practical			2			40		60	100	-	-	16		24	40	2		
PTL-236	Blended Course	Practical			2			40		60	100	-	-	16		24	40	2		
	<b>Total</b>		8		20	40	40	200	120	300	700	0	0	80	48	120	280	20		

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

### Subject-wise course details

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences and Tech.

**Degree:** Plant Biotechnology (PG)

**Course Unit Code:** MPT-231

**Course Unit Title:** Gene Technology,  
Synthetic Biology, Genome Editing and  
Engineering

**Credits allocated:** 4 (4Th+ 0 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 of Molecular Tools and techniques for Gene Cloning, advanced techniques in molecular biology, the concept of synthetic biology.

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

Comprehend the fundamental concepts of gene cloning, tools, and techniques of advanced molecular biology, synthetic biology

### COURSE CONTENTS

#### Theory

**Course Code:** MPT-231

**Course Title:** Gene Technology, Synthetic Biology,  
Genome Editing and Engineering

#### Unit 1. Molecular Tools for Gene Cloning

Nucleases: Exonucleases and Endonucleases, Restriction Enzymes (Type I, Type II, Type III, Type IV & Type V), RNases, Methylases: CpG Methylase, Dam Methylase, Dcm Methylase

Polymerases: DNA Pol I, Klenow Fragments, Reverse Transcriptase, Taq & Pfu Polymerases  
Ligases: T4 DNA Ligase, E.coli DNA Ligase, T4 RNA Ligase, Topoisomerases: Type I(A, B) & Type II(A,B), End Modifying Enzymes: Terminal Transferase, T4 Polynucleotide Kinase, Alkaline Phosphatases, Introduction to cloning vectors, Desirable properties of vectors, Prokaryotic & Eukaryotic Expression Systems (Constitutive & Inducible), Plasmid Vectors, Phage Vectors, Cosmids, Phagemids, BACs, Yeast Vectors, YACs, Lentiviral Vectors, Adenoviral Vectors, Plant Vectors, Insect Vectors.

## **Unit 2. Advanced Techniques in Molecular Biology**

Polymerase Chain Reaction, Quantitative Real-Time PCR, Gel Electrophoresis: AGE & PAGE, Blotting Techniques: Southern, Western & Northern Methods of gene transfer in Plants and Animals: Chemical, Physical & Viral mediated DNA transfer, Construction of Genomic & cDNA Libraries, DNA Sequencing, Protein Engineering: Site-Directed Mutagenesis, Reporter Gene Assays, DNA Protein Interactions: EMSA, DNA Foot-printing, Protein-Protein Interactions: Y2H, Y3H, B1H, B2H, recent trends in molecular biology research, Targeted Genome Editing: ZFNs, TALENs, CRISPRs, Gene Targeting: Knock-ins & Knock-outs, DNA Finger Printing

## **Unit 3. Synthetic Biology-1**

Expression and regulation in prokaryotic and eukaryotic systems including their viruses. Advanced biotechnological methods comprising cloning, mutagenesis, polymerase chain reaction, synthesis of nucleic acids, DNA sequence determination, synthetic genomics, CRISPR- Cas9, directed evolution, alternative splicing and computational modeling. Experimental characterization of structural and functional properties of biomolecules. Bioinformatic analysis and characterization of genes and biomolecules. Basic theoretical and computational modeling of replicating systems. Laboratory highlighting BioBrick cloning and chromoprotein reporters as a methodology in synthetic biology. Ethical aspects.

## **Unit 4: Synthetic Biology-2**

Noise in gene expression: Origin, propagation, consequences, and control, Robustness and evolvability of genetic networks, Bacterial circuits: Toggle switch and repressilator Instructor out of town, Bacterial circuits: Feedback, feed-forward, signal propagators, and band filter, Bacterial communication circuits: Population control and patterning systems, Bacterial communication circuits: Synchronized oscillators, Functional synthetic systems: From

modules to systems, Gene circuit design and engineering: Biobricks/BioFAB and designing software, Synthetic circuits beyond bacteria: Phage, virus, and eukaryotic

### **Unit 5: RNA Engineering and Cell-Biomaterial Engineering**

Introduction Amplify aptamer-encoding DNA, SELEX I: Building a Library-Purify aptamer-encoding DNA, SELEX II: Selecting RNA with target functionality-Prepare RNA by IVT, SELEX III: Technical advances & problem-solving--Purify RNA and run affinity column, Characterizing aptamers--RNA to DNA by RT-PCR, Introduction to porphyrins: chemistry & biology--, Aptamer applications in biology & technology--Aptamer binding assay, Aptamers as therapeutics Introduction--Start-up biomaterials engineering, Introduction to biomaterials; cartilage composition--Initiate cell culture, Basic statistics; standards in scientific communities I--Testing cell viability, Standards in scientific communities II; cell viability--Preparing cells for analysis, Assays for transcription and protein levels--Transcript-level analysis, Cartilage TE: from in vitro and in vivo models to the clinic--Protein-level analysis, Creating your proposal presentation-Wrap-up analysis, Drug and gene delivery; clinical progress in engineering tissues besides cartilage--presentations

### **SUGGESTED READINGS / REFERENCE BOOKS/ TEXTBOOKS**

1. Principles of Gene Manipulation and Genomics, 7<sup>th</sup> Edition – Sandy B. Primrose, Richard Twyman – Blackwell Publishing
2. Gene Cloning and DNA Analysis: An Introduction, 6th Edition - T. A. Brown - John Wiley & Sons.
3. An Introduction to Genetic Engineering, 3rd Edition - Desmond S. T. Nicholl - Cambridge University Press.
4. Molecular Biotechnology: Principles and Applications of Recombinant DNA (link is external)- 4th Edition - Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten - ASM Press
5. Synthetic Biology: Tools and Application by Huimin Zhao.
6. Bioengineering: A conceptual approach by Mirjana Pavlovic.
7. Synthetic biology: a lab manual by Liljeruhm, Josefina; Gullberg, Erik; Forster, Anthony C.
8. Uri Alon, An Introduction to Systems Biology: Design Principles of Biological Circuits, Chapman & Hall/CRC (2006).

9. Eric Davidson, *The Regulatory Genome: Gene Regulatory Networks In Development And Evolution*, Academic Press (2006).
10. Hamid Bolouri, *Computational Modeling of Gene Regulatory Networks - A Primer*, Imperial College Press (1st edition) (2008).

**Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

**Internal Assessment (Marks distribution): 40**

**1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

**2: Home Assignment:**

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10



### 3: Attendance

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

### Molecular Breeding

**University:** MGM University, Aurangabad

**Faculty:** Basic and Applied Sciences

**Institute:** Institute of Biosciences &  
Technology

**Degree:** M.Sc. Plant Biotechnology (PG)

**Course Code:** MPT-232

**Course Title:** Molecular Breeding

**Credits allocated:** 4+0 (4 Th+ 0 Pr)

**Level of Study:** Post-Graduate (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 of plant breeding techniques, Molecular markers-based selection, concept of QT and its mapping Marker-assisted selection techniques in plant breeding.

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

Comprehend the fundamental concepts of plant breeding, Molecular markers in breeding QTL mapping in breeding and Marker assisted selection

## **COURSE CONTENT: UNIT-WISE SYLLABUS**

### **Theory**

**Course Code:** MPT-232

**Course Title:** Molecular Breeding

#### **Unit 1: Principles of plant breeding**

Principles of plant breeding; Breeding methods for self and cross-pollinated crops; Heterosis breeding; Limitations of conventional breeding; Aspects of molecular breeding.

#### **Unit 2: Molecular markers in breeding**

Development of sequence based molecular markers - SSRs and SNPs; Advanced methods of genotyping; Mapping genes for qualitative and quantitative traits.

#### **Unit 3: QTL mapping in breeding**

QTL mapping using structured populations; AB-QTL analysis; Association mapping of QTL; Fine mapping of genes/QTL; Map based gene/QTL isolation and development of gene based markers; Allele mining by TILLING and Eco-TILLING; Use of markers in plant breeding.

#### **Unit 4: Marker assisted selection**

Marker assisted selection (MAS) in backcross and heterosis breeding; Transgenic breeding; Foreground and background selection; MAS for gene introgression and pyramiding; MAS for specific traits with examples.

#### **Unit 5: Missing**

#### **Suggested Readings/References Books/ Text Books**

1. Chittaranjan K. 2006-07. Genome Mapping and Molecular Breeding in Plants. Vols. I-VII. Springer.
2. Newbury HJ. 2003. Plant Molecular Breeding. Blackwell Publ.
3. Weising K, Nybom H, Wolff K & Kahl G. 2005. DNA Fingerprinting in Plants: Principles, Methods and Applications. Taylor & Francis.

#### **Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

### **Internal Assessment (Marks distribution): 40**

#### **1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

#### **2: Home Assignment:**

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

#### **3: Attendance**

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

### **Techniques in Molecular Biology (Practical)**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-233

**Course Title:** Techniques in Molecular  
Biology (Practical)

**Credits allocated:** 4 (0 Th + 4 Pr)

**Level of Study:** PG

**Mode of delivery, planned learning, and teaching method:** Lecture: 6 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 **course content missing**

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

Comprehend the fundamental concepts of **course content missing**

#### **Course content**

**Missing**

#### **Practical Assessment**

Components (TW)	Record Book	Table Viva	Attendance	Total Marks
Internal Marks	10	10	20	40

External Assessment: Semester End Practical	60
Total Marks	100

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

The criteria for attendance

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

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

### MAJOR PROJECT

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-234

**Course Title:** Mini project

**Credits allocated:** 4 (0 Th + 4 Pr)

**Level of Study:** PG

**Mode of delivery, planned learning, and teaching method:** Lecture: 6 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 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.

### Course content

Missing

### Project Assessment (200 Marks)

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

**Ideas of project:**

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

## **Understanding of Subject**

### **1. Implementation:**

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

### **2. Evaluation:**

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

### **3. Project Log:**

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

## **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.

- **Attendance:**

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

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

**Project External Assessment (Marks distribution):120**

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

**Seminar**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-235

**Course Title:** Seminar

**Credits allocated:** 2 (0 Th + 2 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 for the development of presentation skills, students will aware of various tools for presentation.

**Objective:** After the end of this course, students will be able to: make their presentation, develop skill delivering presentation work.

**SEMINAR ASSESMENT (Marks distribution): 100**

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

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

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

**Blended courses**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-236

**Course Title:** Blended courses

**Credits allocated:** 2 (0 Th + 2 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 various blended courses designed for the curriculum.

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

Comprehend the fundamental concepts of the blended courses. They will gain knowledge of different courses by resisting in platform like SWAYAM NPTEL.

### **SOP for Blended Courses**

- It is mandatory for post graduate students to undertake blended courses for concern credits before the completion of the degree.
- Students have the option of choosing any blended courses under the category of mandatory elective courses.
- Students are advised to finalize their choice of programs in consultation with their Blended course coordinator.
- The course facilitator/mentor will conduct the whole course in consultation with Blended course coordinator.
- For PG programs the blended are offered within the regular class hours.
- These courses generally earn concern credits consisting of 1 Credit- 4 week 2 Credit- 8 weeks 3-4 Credit -12 weeks during the completion of semester.
- Students can view the complete details of the courses offered blended courses in their course layout.
- Evaluation pattern is the discretion of the faculty concerned for PG courses will be with only end semester examinations
- Examinations are conducted by the departments concerned and the results are indicated only in Grades in the marks card.
- Minimum pass percentage is 40% for courses under the mandatory category. Grades are awarded only if the student passes.
- These courses are conducted after or before the regular class hours and the courses offered are different in Odd and Even semesters.

- Minimum prescribed attendance for these courses is 85%. Medical and co-curricular claim will be considered only if the student put in 75% physical attendance or the classes.
- Attendance claim shall be submitted to blended course coordinator within 07 days after availing the leave.
- Students who fail to secure the minimum pass marks or required minimum attendance or who discontinue in between the course are required to register afresh. Re-registration is permitted only in the subsequent semester which may be for the same course or any other courses from the choices available during the particular semester.
- He / She submit course syllabus weekly report on the basis of that blended course coordinator conduct their continuous assessment.
- A student is not eligible to graduate without completing OEC mandatory course.
- The course platform for registration are SWAYAM NPTEL, Agmooc and Coursera.

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

### **Assessment of Blended Courses (2 Credit: 100 Marks)**

#### **Internal Evaluation**

Internal Assessment	20 Marks
Weekly Report Submission	20 Marks

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

#### **External Evaluation**

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

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

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

### **Ethics/ Biosafety/ IPR**

**University:** MGM University, Aurangabad      **Faculty:** Basic & Applied Science  
**Institute:** Institute of Biosciences & Technology      **Degree:** M.Sc. Plant Biotechnology  
**Course Code:** MPT-241      **Course Title:** Ethics/ Biosafety/ IPR  
**Credits allocated:** 4 (4 Th + 0 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 of Biosafety Guidelines, levels of biosafety, Intellectual Property Rights, Patents and Patent Laws and bioethics.

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

Comprehend the fundamental concepts of biosafety, levels of biosafety and basic knowledge of Intellectual Property Rights, Patents and Patent Laws and bioethics.

## **COURSE CONTENTS**

### **THEORY**

**Course Code:** MPT-241

**Course Title:** Ethics/ Biosafety/ IPR

#### **Unit 1: Biosafety Introduction**

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

#### **Unit 2: Biosafety Guidelines**

Guidelines and regulations (National and International including Cartagena Protocol)- operation of biosafety guidelines and regulations of the Government of India; Definition of

GMOs & LMOs. Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture. Environmental release of GMOs- Risk Analysis, Assessment, management and communication.

### **Unit 3: Intellectual Property Rights**

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

### **Unit 4: Patents and Patent Laws**

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

### **Unit 5: Bioethics**

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

### **SUGGESTED READINGS / REFERENCE BOOKS/ TEXTBOOKS**

1. Beier F.K, Crespi R.S and Straus T. Biotechnology and Patent protection, Oxford and IBH Publishing Co. New Delhi.
2. Jeffrey M. Gimble, Academia to Biotechnology, Elsevier Academic Press.

3. Rajmohan Joshi (Ed.). 2006. Biosafety and Bioethics. Isha Books, Delhi.
4. Sasson A, Biotechnologies and Development, UNESCO Publications.
5. Senthil Kumar Sadasivam and Mohammed Jaabir M. S. (2008). IPR, Biosafety and Biotechnology Management, Jasen Publications, India.
6. Singh BD. 2007. Biotechnology: Expanding Horizon. Kalyani.

**Assessment Method:**

Course Evaluation /Weightage: The relative weightage to the various test and examinations conducted viz. unit tests, home assignments, seminars, and records maintained during a semester shall be as per the guidelines of the institution.

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

**Internal Assessment (Marks distribution): 40**

**1: Unit Test:**

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

No. of unit test	Total Marks
1	20

- MCQs (05) Marks-5
- Short Notes (any 3) out of 4 Marks-15

**2: Home Assignment:**

In the ongoing academic semester, home assignments are given to students to develop an interest in the subjects and also to improve students writing skills.

No. of Home Assignment	Total Marks
2	10

### 3: Attendance

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

### Big Idea (Project)

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-242

**Course Title:** Big Idea (Project)

**Credits allocated:** 10 (0 Th + 10 Pr)

**Level of Study:** PG

**Mode of delivery, planned learning, and teaching method:** Lecture: 6 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 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.



## Content Missing

### Big Idea External Assessment (Marks distribution): 400

Idea of Project	Understanding of Subject	Literature survey	Attendance	Total Marks
40	40	40	40	160
External Assessment				240
Total Marks				400

#### Attendance:

In ongoing semester attendance are important for students. They are expected to attend all sessions in the semester that are timetabled (practicals, lectures, seminars). The criteria for attendance is given below.

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

#### 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.

### **Understanding of Subject:**

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

#### **1. Implementation:**

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

#### **2. Evaluation:**

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

#### **3. Project Log:**

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

### **Project External Assessment (Marks distribution):120**

External Assessment: Semester End Project Examination						
Components	Project Report	PowerPoint Presentation	Viva Voce	Innovativeness	Individual Contribution	Total
	40	40	40	80	40	240
Total marks						240

**Presentation Skill:** It is one of the main purpose of presentation is to help students develop and improve their communication skills. Following are the criteria of presentation skill.

#### **1. Synopsis:**

- a. Introduction.
- b. Project specifications.
- c. Statistical techniques used and calculations.
- d. Solutions to the problem.

#### **2. PPT:**

- a. General quality of the presentation.
- b. Integration and teamwork.

- c. Interest, content and originality.
- 3. Thesis:
  - a. Introduction.
  - b. Project specifications.
  - c. Statistical techniques used and calculations.
  - d. Solutions to the problem.
  - e. Recommendations and conclusions

**4. Final PPT:**

- a. General quality of the presentation.
- b. Integration and teamwork.
- c. Interest, content and originality.
- d. Results and conclusion

**Blended courses**

**University:** MGM University, Aurangabad

**Faculty:** Basic & Applied Science

**Institute:** Institute of Biosciences & Technology

**Degree:** M.Sc. Plant Biotechnology

**Course Code:** PTL-243

**Course Title:** Blended courses

**Credits allocated:** 2 (0 Th + 2 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 various blended courses designed for the curriculum.

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

Comprehend the fundamental concepts of the blended courses. They will gain knowledge of different courses by resisting in platform like SWAYAM NPTEL.

## **SOP for Blended Courses**

It is mandatory for post graduate students to undertake blended courses for concern credits before the completion of the degree.

- Students have the option of choosing any blended courses under the category of mandatory elective courses.
- Students are advised to finalize their choice of programs in consultation with their Blended course coordinator.
- The course facilitator/mentor will conduct the whole course in consultation with Blended course coordinator.
- For PG programs the blended are offered within the regular class hours.
- These courses generally earn concern credits consisting of 1 Credit- 4 week 2 Credit- 8 weeks 3-4 Credit -12 weeks during the completion of semester.
- Students can view the complete details of the courses offered blended courses in their course layout.
- Evaluation pattern is the discretion of the faculty concerned for PG courses will be with only end semester examinations
- Examinations are conducted by the departments concerned and the results are indicated only in Grades in the marks card.
- Minimum pass percentage is 40% for courses under the mandatory category. Grades are awarded only if the student passes.
- These courses are conducted after or before the regular class hours and the courses offered are different in Odd and Even semesters.
- Minimum prescribed attendance for these courses is 85%. Medical and co-curricular claim will be considered only if the student put in 75% physical attendance or the classes.
- Attendance claim shall be submitted to blended course coordinator within 07 days after availing the leave.
- Students who fail to secure the minimum pass marks or required minimum attendance or who discontinue in between the course are required to register afresh. Re-registration is permitted only in the subsequent semester which may be for the same course or any other courses from the choices available during the particular semester.
- He / She submit course syllabus weekly report on the basis of that blended course coordinator conduct their continuous assessment.

- A student is not eligible to graduate without completing OEC mandatory course.
- The course platform for registration are SWAYAM NPTEL, Agmooc and Coursera.

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

### **Assessment of Blended Courses (2 Credit: 100 Marks)**

#### **Internal Evaluation**

Internal Assessment	20 Marks
Weekly Report Submission	20 Marks

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

#### **External Evaluation**

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

