

MEWAR UNIVERSITY
DEPARTMENT: LIFE SCIENCE
PROGRAMME: M. SC. ZOOLOGY

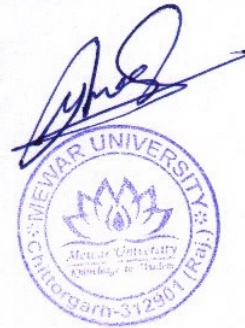
Program Outcomes (POs)

1. **PO-1 Advanced Taxonomic Knowledge:** Graduates will demonstrate an in-depth understanding of the classification, identification, and nomenclature of diverse animal species, showcasing expertise in taxonomic principles and practices.
2. **PO-2 Research Proficiency:** Graduates will be equipped with the skills to design, execute, and analyze scientific experiments and field studies in zoology, contributing to the expansion of knowledge in various subfields.
3. **PO-3 Morphological and Physiological Expertise:** Graduates will possess a comprehensive knowledge of animal morphology and physiology, enabling them to explain the structure-function relationships and adaptations of different species to their environments.
4. **PO-4 Ecological Awareness:** Graduates will be capable of analyzing and interpreting ecological interactions, population dynamics, and ecosystem processes, allowing them to address conservation challenges and environmental issues.
5. **PO-5 Evolutionary Understanding:** Graduates will demonstrate an advanced grasp of evolutionary theory, being able to apply it to explain the origin and diversification of animal species, as well as to predict potential evolutionary trends.
6. **PO-6 Data Analysis and Interpretation:** Graduates will be proficient in using statistical and computational tools to analyze and interpret complex biological data, enhancing their ability to draw meaningful conclusions from research findings.
7. **PO-7 Communication Skills:** Graduates will be adept at conveying scientific concepts and research findings through oral presentations, written reports, and visual representations, catering to both scientific and general audiences.
8. **PO-8 Conservation and Biodiversity:** Graduates will have a deep understanding of biodiversity conservation strategies, including the assessment of threats to species and habitats, and the formulation of effective conservation plans.
9. **PO-9 Ethical and Professional Conduct:** Graduates will demonstrate a strong sense of ethical responsibility in their interactions with animals and ecosystems, adhering to ethical guidelines and professional standards in their zoological research and practices.



Program-Specific Outcomes (PSOs)

- 1. PSO-1 Taxonomic Proficiency:** Graduates will demonstrate an advanced understanding of animal diversity, classification, and nomenclature. They will be able to accurately identify and classify various taxa across different animal groups using both traditional and molecular techniques, showcasing expertise in taxonomy and systematics.
- 2. PSO-2 Research and Experimental Skills:** Graduates will acquire comprehensive research skills in zoology, including designing and conducting experiments, collecting and analyzing data, and interpreting results. They will be proficient in applying various laboratory and field techniques to address scientific inquiries related to animal behavior, physiology, ecology, and evolution.
- 3. PSO-3 Biodiversity Conservation and Management:** Graduates will possess in-depth knowledge of biodiversity conservation strategies, including understanding threats to species and ecosystems, evaluating conservation policies, and implementing sustainable management practices. They will be capable of designing and executing projects aimed at preserving and rehabilitating animal populations and their habitats.
- 4. PSO-4 Communication and Outreach:** Graduates will demonstrate effective communication skills by presenting scientific information to both technical and non-technical audiences. They will be able to write clear and concise reports, publish research findings in peer-reviewed journals, and participate in public engagement activities to raise awareness about zoological concepts, ecological issues, and conservation efforts.



Course Outcomes (COs)

Course: Sem I Paper 1 Animal Diversity of Invertebrates:

1. **CO-1** To enable the students to identify and study about different species of vertebrates and Invertebrates and their phylogenetic, morphological, ecological and pathological significance.
2. **CO-2** Enable them to prepare keys and cladograms using appropriate software's or tools.
3. **CO-3** To understand the behaviour and activity pattern of different organisms based on field observation with respect to diurnal and seasonal.
4. **CO-4** To develop the skills in student to do different statistical analysis using various software's and online tools.

Course: Sem I Paper 2 Ecology and Evolution:

1. **CO-1** Students will demonstrate a deep understanding of ecological concepts, theories, and principles, including population dynamics, community interactions, ecosystem structure, and nutrient cycling.
2. **CO-2** Students will be able to assess and analyze plant biodiversity at various scales, from local to global, and understand the factors influencing its distribution
3. **CO-3** Students will explore the mechanisms of evolution and adaptation in plant populations.
4. **CO-4** Students will evaluate the roles of plants in ecosystem functioning and the provisioning of ecosystem services.
5. **CO-5** Students will develop advanced research skills and critical thinking abilities in the context of ecology and evolution.

Course: Sem I Paper 3 Cell Biology and Molecular Genetics:

1. **CO-1** The cell structures in relation to function of cells the fundamental unit of life, are concerned in this course along with molecules present in cells.
2. **CO-2** Apply the principles of cell biology in designing experiment, statistical analysis, and interpretation of results
3. **CO-3** Operate and solve exercise using computation statistics software.
4. **CO-4** Get acquainted with basic approach in the research methodology.
5. **CO-5** Know about the induction of polyploidy in plants using colchicine's, methods of application of colchicine.

Course: Sem I Paper 4 Biochemistry:

1. **CO-1** Learn the properties, Enzyme catalysis and activation energy– Mechanism of enzyme action
2. **CO-2** Study the structure and properties of Macromolecules
3. **CO-3** Gain skill on working principles of pH meter, colorimeter and centrifuge
4. **CO-4** Learn the technique of Electrophoresis & Chromatography



Course: Sem II Paper 1 Vertebrate and Comparative Anatomy:

1. CO-1 Knowledge of Origin, Evolution and general organisation of Chordates.
2. CO-2 Knowledge of Evolution of heart, lungs and urino-genital organs of vertebrates
3. CO-3 Knowledge of comparative anatomy of all systems of vertebrates.
4. CO-4 Knowledge of flight and aquatic adaptations in birds and mammals.

Course: Sem II Paper 2 Animal Physiology:

1. CO-1 Understand all physiological processes of vertebrates & analyse them biochemically
2. CO-2 Correlate the comparative physiology of the systems and understand their regulation & control
3. CO-3 Compare the structure, functions and regulation of the receptor organs of vertebrates
4. CO-4 Understand the structure, function and regulation of endocrine & neuroendocrine glands.

Course: Sem II Paper 3 Molecular Biology:

After successful completion of this course, students will be able to:

1. CO-1 Acquaint with concepts in prokaryotic, eukaryotic, and viral genetics
2. CO-2 Explain central dogma of molecular biology (replication, transcription, and translation)
3. CO-3 Enlist and explain types of mutation, gene regulation and transposable element
4. CO-4 Conversant with Laboratory Techniques viz. Microscopy, SEM & TEM, Ultracentrifugation, fractionation, Electrophoresis, PCR, GISH, FISH and Immunochemical techniques. The flow cytometry and confocal microscopy in karyotype analysis.
5. CO-5 Isolation of plant DNA and its quantification.

Course: Sem II Paper 4 Bioinformatics:

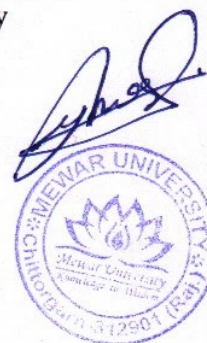
1. CO-1 Use the Bioinformatics toll in Biological data analysis.
2. CO-2 Able to explain the methods used for characterizing and managing Biological data.
3. CO-3 Classify different types of Biological Databases.

Course: Sem III Paper 1 Immunology:

1. CO-1 Provide an intensive and in-depth knowledge to the students in immunology
2. CO-2 Understand the role of immunology in human health and well-being
3. CO-3 Familiarize the students the new developments in immunology
4. CO-4 Learn the way body fights foreign bodies.
5. CO-5 Understand the risks in transplantation of organs.

Course: Sem III Paper 2 Developmental Biology:

1. CO-1 Learn the concepts and process in developmental biology

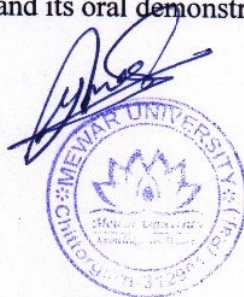


2. **CO-2** Understand and appreciate the genetic mechanisms and the unfolding of the same during development
3. **CO-3** Create awareness on new developments in embryology and its relevance to Man
4. **CO-4** Acquire knowledge on teratogenesis and generate awareness in society.
5. **CO-5** Understand the causes of infertility and can take preventive measures.

Course: Sem IV Paper 1 Major Research Project:

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

1. **CO-1** To develop synopsis of a defined research problem.
2. **CO-2** To conduct the bench work.
3. **CO-3** To prepare the research report and its oral demonstrations.



MEWAR UNIVERSITY
DEPARTMENT: LIFE SCIENCE
PROGRAMME: M.SC. MICROBIOLOGY

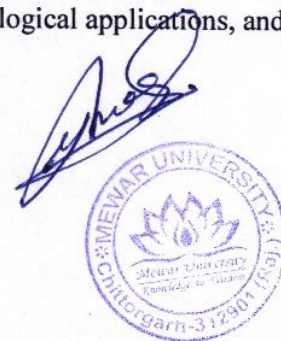
Program Outcomes (POs)

1. **PO-1 Advanced Knowledge:** Graduates will possess a comprehensive understanding of microbiological principles, including microbial physiology, genetics, ecology, and pathogenesis, reflecting an advanced level of expertise in the field.
2. **PO-2 Research Proficiency:** Graduates will be proficient in designing, conducting, and analyzing microbiological research projects, demonstrating the ability to contribute to the advancement of scientific knowledge in microbiology.
3. **PO-3 Diagnostic Skills:** Graduates will be equipped with the skills to identify and diagnose microbial infections accurately, using cutting-edge techniques and methodologies, contributing to the effective management of infectious diseases.
4. **PO-4 Innovative Techniques:** Graduates will be adept at applying innovative technologies such as genomics, metagenomics, and bioinformatics to analyze and interpret complex microbiological data, leading to novel insights and discoveries.
5. **PO-5 Critical Thinking:** Graduates will demonstrate the ability to critically evaluate scientific literature, formulate hypotheses, and apply logical reasoning to address microbiological challenges and unanswered questions.
6. **PO-6 Effective Communication:** Graduates will possess strong written and oral communication skills, enabling them to effectively convey complex microbiological concepts to both scientific and non-scientific audiences.
7. **PO-7 Ethical Awareness:** Graduates will exhibit a deep understanding of ethical considerations in microbiological research, particularly in areas such as biotechnology, biosecurity, and responsible conduct of research.
8. **PO-8 Collaboration and Leadership:** Graduates will be skilled in collaborative teamwork, able to work effectively in multidisciplinary research settings, and demonstrate leadership qualities for guiding and managing microbiology-related projects.
9. **PO-8 Career Adaptability:** Graduates will have the flexibility to pursue diverse career paths, including academia, industry, healthcare, and public health, due to their well-rounded knowledge and skills in microbiology.



Program-Specific Outcomes (PSOs)

1. **PSO-1Advanced Microbial Knowledge:** Graduates will demonstrate an advanced understanding of microbial diversity, physiology, genetics, and interactions. They will be able to apply this knowledge to analyze and solve complex problems in various fields such as medical microbiology, environmental microbiology, and industrial microbiology.
2. **PSO-2Research Proficiency:** Graduates will be proficient in conducting independent research in microbiology. They will possess the skills to design experiments, collect and analyze data, interpret results, and draw scientifically sound conclusions. They should be capable of contributing to advancements in microbiological research and making meaningful contributions to scientific literature.
3. **PSO-3Laboratory Techniques and Instrumentation:** Graduates will have gained expertise in a wide range of laboratory techniques and instrumentation relevant to microbiology. This includes skills in culturing diverse microorganisms, using advanced microscopy, molecular biology techniques (PCR, DNA sequencing), and bioinformatics tools. They will be adept at applying these techniques to both basic and applied microbiology research.
4. **PSO-4Critical Thinking and Problem-Solving:** Graduates will have developed strong critical thinking and problem-solving skills in the context of microbiology. They will be able to analyze complex biological systems, identify challenges, and devise innovative strategies to address microbiology-related issues. This could involve tackling problems related to antimicrobial resistance, infectious disease outbreaks, biotechnological applications, and more.



Course Outcomes (COs)

Course: Sem I Paper 1 Instrumentation and Analytical Techniques:

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

1. **CO-1** Apply basic principles of different analytical techniques in analytical work.
2. **CO-2** Concept of electromagnetic radiation, absorption spectrum, Beer's law and Lamberts law
3. **CO-3** Use spectroscopy, microscopy, centrifugation, electrophoretic techniques and radioactivity in biotechnological applications Demonstrate principle and working of various instruments
4. **CO-4** Use various techniques for solving industrial and research problem

Course: Sem I Paper 2 Fundamentals of Microbiology:

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

1. **CO-1** Get an idea about the historical events in microbiology
2. **CO-2** Understand the diversity in microbiology
3. **CO-3** Know the scope of Microbiology
4. **CO-4** Understand the taxonomic classification of microorganisms
5. **CO-5** Know the general characteristics of Bacteria, fungi, algae and viruses

Course: Sem I Paper 3 Cell Biology and Molecular Genetics:

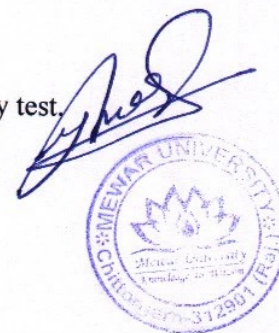
By the end of this course, the students will be able to:

1. **CO-1** The cell organization in prokaryotes: structure and synthesis of bacterial cell wall and other cell organelles or structures present in bacteria. Importance of antibiotics, their mode of action and development of antibiotic resistance.
2. **CO-2** The cell organization in eukaryotes: structure, function and protein transport of membrane, structure and functions of other cell organelles, cytoskeleton, genetic organization and concept of protein targeting.
3. **CO-3** Cell division in eukaryotes i.e., Mitosis and Meiosis. Cell cycle and its regulation. Mechanism and pathways of cell proliferation and apoptosis.
4. **CO-4** Basics of signal transduction. Role of second messengers and protein kinases in signal transduction. Mechanism of Quorum sensing. Production and application of Biofilms.
5. **CO-5** Various methods of gene transfer in bacteria and their mechanism: Transduction, Transformation and Conjugation. Transposons present in prokaryotes and their mechanism of transposition. Types and role of Retrotransposons.

Course: Sem I Paper 4 Biochemistry:

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

1. **CO-1** Instruments used in microbiology, sterilization techniques etc.
2. **CO-2** Gram staining, culture media preparation and antibiotic susceptibility test.



3. **CO-3** At the end of each biochemical estimation method students will be able to qualitatively and quantitatively determine the level of various test macromolecules in a given sample.
4. **CO-4** Students will also be able to perform comparative estimations of same sample via using different assays i.e., estimation of proteins by Molisch's Test, Fehling's Test and Benedict's test etc.
5. **CO-5** Students will also be able to determine the sensitivity of each method used for single test macromolecule so that the test molecules present in a very low amount can also be estimated using the most sensitive method. Explain typical growth curve of bacteria

Course: Sem II Paper 1 Genetic Engineering:

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

1. **CO-1** Learn about different enzymes used in genetic engineering for DNA manipulations
2. **CO-2** To study different vectors and their characteristics
3. **CO-3** Transformation methods and their use in Genetic Engineering.
4. **CO-4** Using genetic engineering for mutagenesis, gene silencing, and amplification of DNA, DNA Sequencing

Course: Sem II Paper 2 Fermentation Technology:

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

1. **CO-1** Microbes involved in fermentation.
2. **CO-2** The basics of fermentation technology.
3. **CO-3** General design of fermented, media and the process of fermentation.
4. **CO-4** Optimization of fermentation process.
5. **CO-5** Use of microbes for production of important industrial products.

Course: Sem II Paper 3 Molecular Biology:

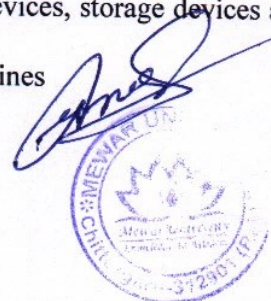
By the end of this course, the students will be able to:

1. **CO-1** Understand and describe various concepts – related with gene and its regulation
2. **CO-2** Understand and explain various processes by which gene transfer occurs amongst microbes
3. **CO-3** Explain the causes of gene mutation and their effect on cell
4. **CO-4** Understand and explain the principles, methodology and application of various bio instruments like spectrophotometer, electrophoresis, chromatography, centrifuge etc

Course: Sem II Paper 4 Bioinformatics:

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

1. **CO-1** Basics knowledge of computers, input and output devices, storage devices and different operating systems
2. **CO-2** Different Biological data file formats and Search engines



3. **CO-3** Biological databases Primary nucleotide sequence and Primary Protein sequence databases. Secondary databases, Microbiology databases
4. **CO-4** Sequence analysis like Pair wise Sequence Alignment, Sequence similarity search programs and Substitution matrices.
5. **CO-5** Protein structure prediction: Homology modelling, Primer Designing, Multi-dimensional protein identification technology – identification using database.

Course: Sem III Paper 1 Microbial Physiology and Metabolism:

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

1. **CO-1** Characteristic of Enzymes, enzyme inhibition and kinetics
2. **CO-2** Carbohydrate metabolism, significance of glycolysis and ETC, untreated diabetes
3. **CO-3** Lipid metabolism and production of ketone bodies
4. **CO-4** Protein metabolism, role of urea cycle and errors of protein metabolism
5. **CO-5** Biosynthesis and degradation of purine and pyrimidine

Course: Sem III Paper 2 Virology:

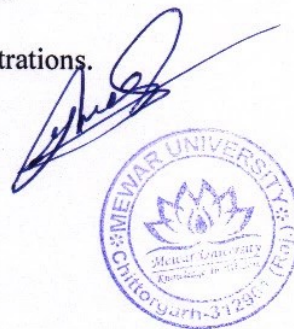
By the end of this course, the students will be able to:

1. **CO-1** Know how viruses are classified
2. **CO-2** Understand the architecture of viruses and their genomes
3. **CO-3** Know the methods used in studying viruses
4. **CO-4** Describes the basic steps in virus replication and disease
5. **CO-5** Discern the basic replication strategies of viruses, virus gene expression, modes of replication and transmission, the interaction of viruses with cells and prevention of virus infections and evolution of viruses.

Course: Sem IV Paper 1 Major Research Project:

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

1. **CO-1** To develop synopsis of a defined research problem.
2. **CO-2** To conduct the bench work.
3. **CO-3** To prepare the research report and its oral demonstrations.



MEWAR UNIVERSITY
DEPARTMENT: LIFE SCIENCE
PROGRAMME: M.SC. ENVIRONMENTAL SCIENCE

Program Outcomes (POs)

1. **PO-1 Scientific Expertise:** Graduates will demonstrate a deep understanding of environmental science principles, theories, and methodologies, allowing them to critically analyze complex environmental issues.
2. **PO-2 Research Proficiency:** Graduates will be proficient in designing, conducting, and evaluating scientific research related to environmental challenges, contributing to the advancement of knowledge in the field.
3. **PO-3 Interdisciplinary Collaboration:** Graduates will be skilled at collaborating across disciplines, working with experts in various fields to develop holistic solutions to environmental problems.
4. **PO-4 Data Analysis and Interpretation:** Graduates will be adept at collecting, analyzing, and interpreting environmental data using advanced statistical and computational methods, aiding in evidence-based decision-making.
5. **PO-5 Policy and Regulation:** Graduates will understand the legal and regulatory frameworks related to environmental issues, enabling them to contribute to the formulation and implementation of effective environmental policies.
6. **PO-6 Environmental Impact Assessment:** Graduates will possess the skills to assess the potential environmental impacts of various projects, policies, or actions, providing valuable insights for sustainable development.
7. **PO-7 Communication Skills:** Graduates will effectively communicate complex environmental concepts and findings to diverse audiences, including policymakers, communities, and the public.
8. **PO-8 Sustainability Solutions:** Graduates will develop innovative and practical solutions to promote environmental sustainability, addressing issues such as resource management, climate change, and conservation.
9. **PO-9 Ethical and Social Responsibility:** Graduates will understand the ethical dimensions of environmental science and demonstrate a commitment to promoting social responsibility, equity, and environmental justice in their work.



Program Specific Outcomes (PSOs)

- 1. PSO 1 Environmental Assessment and Management:** Graduates will be able to conduct comprehensive environmental assessments, including data collection, analysis, and interpretation, to identify potential environmental issues and formulate effective management strategies to mitigate or prevent adverse environmental impacts.
- 2. PSO 2 Sustainable Resource Management:** Graduates will possess the knowledge and skills to critically analyze natural resource management practices and propose sustainable solutions for the conservation and responsible utilization of natural resources, considering factors such as biodiversity conservation, ecosystem services, and socio-economic implications.
- 3. PSO 3 Environmental Policy and Regulations:** Students will develop a deep understanding of national and international environmental policies, laws, and regulations. They will be capable of assessing policy effectiveness, advocating for environmental protection, and contributing to the development of sound environmental policies that address contemporary environmental challenges.
- 4. PSO 4 Research and Communication:** Graduates will be proficient in designing and executing scientific research projects related to environmental science. They will demonstrate the ability to collect and analyze data, employ appropriate research methodologies, and effectively communicate their findings through written reports, oral presentations, and visual representations, contributing to the advancement of knowledge in the field of environmental science.



Course Outcomes (COs)

Course: Sem I Paper 1 Basic Concepts of Ecology and Environment:

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

1. **CO-1** Introduces the basics of Environmental Science and structure and function of different compartments of the Environment.
2. **CO-2** Provides scientific perspective of the issues confronting our present-day environment
3. **CO-3** Enables to understand the national and international issues related to atmosphere, water, soil and land use, biodiversity, global warming and climate changes, mineral and energy resources, and environmental impact assessment and environmental audit

Course: Sem I Paper 2 Earth Processes and Natural Cycles:

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

1. **CO-1** Understand the geophysical processes as the drivers of different types of hazards.
2. **CO-2** Appreciate how human activities interface with the geophysical processes in causing and/or accentuating natural hazard.
3. **CO-3** Learn the mitigation approaches, their choices and alternatives.
4. **CO-4** Develop foundations for hazard, risk and vulnerability assessment

Course: Sem I Paper 3 Natural Resources and Their Conservation:

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

1. **CO-1** Understand systematically the natural resources and biodiversity and its vital role.
2. **CO-2** Sensitize the role and need of biodiversity conservation in the context of various developmental pathways of mankind.
3. **CO-3** Examined the policy framework within which the development processes are designed.
4. **CO-4** Estimate the significance of biodiversity of Northeast India

Course: Sem I Paper 4 Environmental Pollution and Monitoring:

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

1. **CO-1** Ability to identify and quantify the magnitude and intensity of Environmental pollution problems.
2. **CO-2** Ability to undertake environmental sampling and analysis with respect to air, water and noise pollution.
3. **CO-3** Ability to suggest the environmental control /management plan for environmental pollution problems



Course: Sem II Paper 1 Biodiversity Conservation:

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

1. **CO-1** Understand systematically the natural resources and biodiversity and its vital role.
2. **CO-2** Sensitize the role and need of biodiversity conservation in the context of various developmental pathways of mankind.
3. **CO-3** Examined the policy framework within which the development processes are designed.
4. **CO-4** Estimate the significance of biodiversity of Northeast India.

Course: Sem II Paper 2 Environmental Impact Assessment:

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

1. **CO-1** Ability to appreciate the philosophies and historical development of EIA in India and elsewhere.
2. **CO-2** Ability to demonstrate sound understanding of the EIA process and the methodologies to prepare an EIS.
3. **CO-3** Ability to critically examine development actions with the fundamentals understanding of EIA and sustainable development.

Course: Sem II Paper 3 Environmental and Occupational Health:

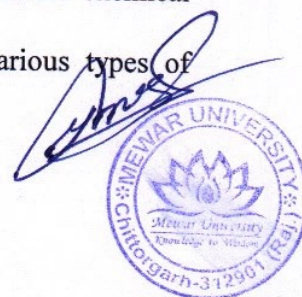
By the end of this course, the students will be able to:

1. **CO-1** Students will demonstrate the ability to assess and manage environmental and occupational health risks.
2. **CO-2** Students will gain an in-depth understanding of the toxicological principles underlying the effects of environmental pollutants and occupational hazards on human health.
3. **CO-3** Students will develop skills in monitoring and assessing air and water quality, including the measurement of pollutants, identification of pollution sources, and interpretation of monitoring data.
4. **CO-4** Students will explore occupational health and safety regulations and standards, learning how to apply them to various workplace settings.
5. **CO-5** Students will examine the role of environmental and occupational health in public policy and decision-making.

Course: Sem II Paper 4 Instrumentation and Environmental Analysis:

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

1. **CO-1** Demonstrate proficiency in practical hands-on field experiences for chemical analysis which is routinely performed in environmental science.
2. **CO-2** Perform sample collection, handling and preservation of various types of samples following protocol.



3. **CO-3** Demonstrate proficiency in a variety of analytical techniques and instruments utilized in environmental chemical analysis, for example, pH and dissolved oxygen meters, and various spectrophotometers.
4. **CO-4** Calculate working solution volumes and concentrations, generate linear regressions, and execute computerized spreadsheets. Report analytical results.
5. **CO-5** Record field and lab data using standard operating procedures.

Course: Sem III Paper 1 Environmental Engineering and Waste Management:

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

1. **CO-1** Ability to demonstrate sound understanding of the waste generation process and characteristics of different types of solid wastes.
2. **CO-2** Ability to address the waste management processes through cradle-to-grave perspectives. Ability to assess the underlying science behind the waste driven pollution.
3. **CO-3** Ability to apply recycling vis-à-vis resource recovery technologies for useful conversion of specific waste type to eco-friendly products.

Course: Sem III Paper 2 Environmental Laws and Ethics:

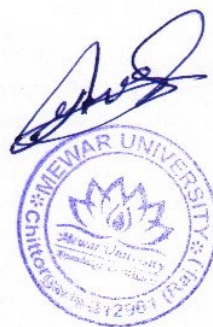
By the end of this course, the students will be able to:

1. **CO-1** Students will demonstrate a comprehensive understanding of the key environmental laws, regulations, and policies at the national and international levels.
2. **CO-2** Students will critically evaluate ethical theories and principles related to environmental issues.
3. **CO-3** Students will explore the role of various stakeholders, including government agencies, non-governmental organizations, and local communities, in shaping environmental policy and governance.
4. **CO-4** Students will examine the intersections of environmental issues with social justice and equity concerns.
5. **CO-5** Students will integrate their knowledge of environmental laws, ethics, and sustainability to propose strategies for achieving sustainable development goals.

Course: Sem IV Paper 1 Major Research Project:

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

1. **CO-1** To develop synopsis of a defined research problem.
2. **CO-2** To conduct the bench work.
3. **CO-3** To prepare the research report and its oral demonstrations.



MEWAR UNIVERSITY
DEPARTMENT: LIFE SCIENCE
PROGRAMME: M. Sc. Botany

Program Outcomes (POs)

1. **PO-1 Comprehensive Plant Knowledge:** Graduates will demonstrate a deep understanding of plant biology, taxonomy, morphology, physiology, and ecology, enabling them to analyze and interpret various aspects of plant life.
2. **PO-2 Advanced Research Skills:** Graduates will be proficient in designing and conducting scientific research projects in botany, including formulating hypotheses, collecting and analyzing data, and drawing meaningful conclusions.
3. **PO-3 Expertise in Plant Genetics and Biotechnology:** Graduates will possess advanced knowledge of plant genetics, molecular biology, and biotechnological techniques, allowing them to contribute to advancements in crop improvement, genetic engineering, and conservation efforts.
4. **PO-4 Ecological Awareness:** Graduates will understand the complex interactions between plants and their environment, equipping them to address environmental challenges, such as habitat degradation, invasive species, and climate change impacts.
5. **PO-5 Conservation and Biodiversity Management:** Graduates will be capable of developing strategies for conserving plant species and biodiversity, both in natural ecosystems and botanical gardens, contributing to global conservation efforts.
6. **PO-6 Effective Communication Skills:** Graduates will be able to communicate their findings and ideas clearly and effectively through written reports, presentations, and publications, fostering collaboration and knowledge dissemination within the scientific community.
7. **PO-7 Ethical and Sustainable Practices:** Graduates will recognize the ethical considerations associated with plant research, cultivation, and resource use, promoting sustainable practices and responsible stewardship of plant resources.
8. **PO-8 Interdisciplinary Collaboration:** Graduates will be adept at collaborating with professionals from various disciplines, such as ecology, agriculture, forestry, and horticulture, to address multifaceted challenges in the realm of plant sciences.
9. **PO-9 Career Readiness:** Graduates will be prepared for diverse career paths, including academic research, botanical garden management, environmental consulting, biotechnology industries, and governmental agencies, owing to their broad and specialized knowledge in botany.



Program Specific Outcomes (PSOs)

1. **PSO-1 Plant Taxonomy and Diversity:** Graduates of the M.Sc. Botany program will be able to demonstrate a deep understanding of plant taxonomy, classification systems, and the diversity of plant species. They will have the ability to identify and categorize various plant species, including their morphological, anatomical, and molecular characteristics.
2. **PSO-2 Advanced Research Skills:** Students completing the M.Sc. Botany program will have developed advanced research skills, including the ability to design and conduct experiments, collect and analyze data, and draw scientifically sound conclusions. They will be equipped with the knowledge of various research methodologies used in botanical studies.
3. **PSO-3 Conservation and Environmental Stewardship:** Graduates will be able to critically assess environmental issues related to plant ecosystems, biodiversity loss, and habitat degradation. They will possess the skills to develop and implement strategies for the conservation and sustainable management of plant species and ecosystems, contributing to environmental stewardship.
4. **PSO-4 Plant Biotechnology and Applied Botany:** Students will have gained proficiency in the application of biotechnological techniques to plant improvement, conservation, and production. They will be capable of utilizing biotechnological tools for genetic modification, tissue culture, and other innovative methods to address challenges in agriculture, horticulture, and pharmaceuticals.



Course Outcomes (COs)

Course: Sem I Paper 1 Biology and Diversity of Plants (Microbes, Algae and Fungi):

1. **CO-1** Learn about the structure, pigmentation, food reserves and methods of reproduction of Algae
2. **CO-2** Learn about the structure, pigmentation, food reserves and methods of reproduction of Fungi
3. **CO-3** Know about the Economic importance of algae, Fungi and lichen.
4. **CO-4** Studied some plant diseases with special reference to the causative agents, symptoms, etiology and control measures.

Course: Sem I Paper 2 Ecology and Evolution:

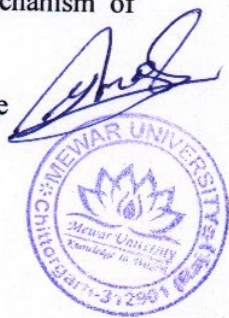
1. **CO-1** Students will demonstrate a deep understanding of ecological concepts, theories, and principles, including population dynamics, community interactions, ecosystem structure, and nutrient cycling.
2. **CO-2** Students will be able to assess and analyze plant biodiversity at various scales, from local to global, and understand the factors influencing its distribution
3. **CO-3** Students will explore the mechanisms of evolution and adaptation in plant populations.
4. **CO-4** Students will evaluate the roles of plants in ecosystem functioning and the provisioning of ecosystem services.
5. **CO-5** Students will develop advanced research skills and critical thinking abilities in the context of ecology and evolution.

Course: Sem I Paper 3 Cell Biology and Molecular Genetics:

1. **CO-1** The cell structures in relation to function of cells the fundamental unit of life, are concerned in this course along with molecules present in cells.
2. **CO-2** Apply the principles of cell biology in designing experiment, statistical analysis, and interpretation of results
3. **CO-3** Operate and solve exercise using computation statistics software.
4. **CO-4** Get acquainted with basic approach in the research methodology.
5. **CO-5** Know about the induction of polyploidy in plants using colchicine's, methods of application of colchicines.

Course: Sem I Paper 4 Biochemistry:

1. **CO-1** Learn the properties, Enzyme catalysis and activation energy– Mechanism of enzyme action
2. **CO-2** Study the structure and properties of Macromolecules
3. **CO-3** Gain skill on working principles of pH meter, colorimeter and centrifuge
4. **CO-4** Earn the knowledge of Electrophoresis & Chromatography techniques



Course: Sem II Paper 1 Biology and Diversity of Archegoniate:

1. **CO-1** Algae can grow quite well in waste water where other organisms would not survive. Phycologists have developed ways to clean up waste water naturally by using algae.
2. **CO-2** As the course includes both fundamental and applied aspects of phycology, the students will be benefitted by both and this can direct them towards research in the field of phycology.
3. **CO-3** Microbiology is one of the most vital fields hence studying microbiology will make the students skilful in understanding the basic concept if role of microorganisms in several industries.
4. **CO-4** Bryophytes, Pteridophytes and gymnosperm have immense ecological and evolutionary significance. Understanding that will be instrumental for students to understand how adaptation played an important role in transition to land habit.
5. **CO-5** All the groups have tremendous economic importance as well in form of availability of tannins, resin, gum etc and other economically important products produced by these group of plants. Knowledge about the economic aspect of these groups of plants will be important.

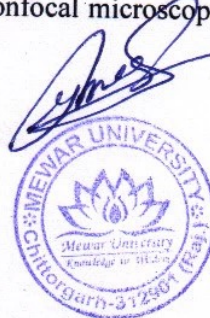
Course: Sem II Paper 2 Plant Physiology:

1. **CO-1** Students will be able to understand the various physiological life processes in plants
2. **CO-2** They will also gain about the various uptake and transport mechanisms in plants and are able to coordinate the various processes.
3. **CO-3** They understand the role of various hormones, signalling compounds, thermodynamics and enzyme kinetics. During the course students will gain knowledge about various mechanisms such as channel or transport proteins involved in nutrient uptake in plants.

Course: Sem II Paper 3 Molecular Biology:

After successful completion of this course, students will be able to:

1. **CO-1** Acquaint with concepts in prokaryotic, eukaryotic, and viral genetics
2. **CO-2** Explain central dogma of molecular biology (replication, transcription, and translation)
3. **CO-3** Enlist and explain types of mutation, gene regulation and transposable element
4. **CO-4** Conversant with Laboratory Techniques viz. Microscopy, SEM & TEM, Ultracentrifugation, fractionation, Electrophoresis, PCR, GISH, FISH and Immunochemical techniques. The flow cytometry and confocal microscopy in karyotype analysis.
5. **CO-5** Isolation of plant DNA and its quantification.



Course: Sem II Paper 4 Bioinformatics:

1. **CO-1** Use the Bioinformatics toll in Biological data analysis.
2. **CO-2** Able to explain the methods used for characterizing and managing Biological data.
3. **CO-3** Classify different types of Biological Databases.

Course: Sem III Paper 1 Structural and Reproductive Plant Biology:

1. **CO-1** Students will able to differentiate reproductive organs at Morphological, Anatomical, Physiological and Biochemical level.
2. **CO-2** This knowledge will be help to apply in agriculture for n production of hybrids.
3. **CO-3** The allergic problems in Humans can be justified on the basis of pollens.

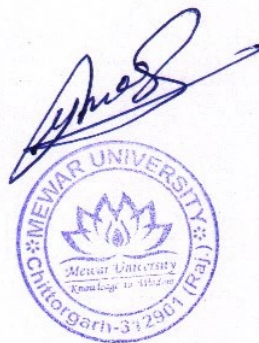
Course: Sem III Paper 2 Plant Systematics & Resources Utilization:

1. **CO-1** Plant Systematics and Evolution aims to bridge the specific subject areas in plant systematics and evolution, encompassing evolutionary, phylogenetic, genomic and biogeographically studies at the population and higher taxonomic levels.
2. **CO-2** Understand the structural adaptations of plants with respect to diverse environmental conditions.
3. **CO-3** It also helps us to distinguish between monocots, dicots, and gymnosperms. Such a study is linked to plant physiology

Course: Sem IV Paper 1 Major Research Project:

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

1. **CO-1** To develop synopsis of a defined research problem.
2. **CO-2** To conduct the bench work.
3. **CO-3** To prepare the research report and its oral demonstrations.



MEWAR UNIVERSITY
DEPARTMENT: LIFE SCIENCE
PROGRAMME: M. SC. BIOTECHNOLOGY

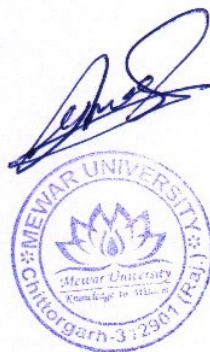
Program Outcomes (POs)

1. **PO-1 Advanced Technical Proficiency:** Graduates will demonstrate a strong command of biotechnological techniques, methodologies, and laboratory skills, enabling them to independently conduct complex experiments and analyses.
2. **PO-2 Research Competence:** Graduates will possess the ability to design, execute, and interpret advanced research projects in various areas of biotechnology, contributing to the expansion of scientific knowledge and innovation in the field.
3. **PO-3 Interdisciplinary Collaboration:** Graduates will be adept at collaborating with professionals from diverse disciplines, fostering effective teamwork and communication in multidisciplinary research and development settings.
4. **PO-4 Innovation and Problem-Solving:** Graduates will exhibit the capacity to identify challenges in biotechnology and devise innovative solutions by applying critical thinking, creativity, and a deep understanding of scientific principles.
5. **PO-5 Ethical Awareness:** Graduates will recognize and address ethical considerations in biotechnological research, demonstrating a commitment to responsible and sustainable practices while working on cutting-edge advancements.
6. **PO-6 Effective Communication:** Graduates will communicate complex scientific concepts clearly and persuasively, both in written and oral forms, facilitating the dissemination of research findings to both scientific and lay audiences.
7. **PO-7 Technology Application:** Graduates will be proficient in the application of emerging technologies such as genomics, proteomics, bioinformatics, and synthetic biology, enabling them to contribute to advancements in fields like personalized medicine and industrial biotechnology.
8. **PO-8 Industry Readiness:** Graduates will be equipped with the skills necessary to excel in the biotechnology industry, including regulatory compliance, quality control, and project management, making them valuable assets to biotech companies.
9. **PO-9 Continual Learning and Adaptability:** Graduates will recognize the dynamic nature of biotechnology and its rapid evolution, and they will exhibit a commitment to continuous learning, adaptability, and staying updated with the latest advancements in the field.



Program-Specific Outcomes (PSOs)

- 1. PSO-1 Advanced Biotechnological Knowledge:** Graduates of the M.Sc. Biotechnology program will demonstrate a deep understanding of the fundamental principles, techniques, and emerging trends in biotechnology. They will possess comprehensive knowledge of molecular biology, genetic engineering, bioinformatics, and other core areas, enabling them to analyze and solve complex biotechnological challenges.
- 2. PSO-2 Experimental and Analytical Proficiency:** Upon completion of the program, students will exhibit proficiency in designing and conducting advanced biotechnological experiments. They will be skilled in utilizing cutting-edge laboratory techniques, instruments, and software tools for genetic manipulation, protein expression, cell culture, and bioinformatics analysis. Graduates will effectively analyze experimental data and draw scientifically sound conclusions.
- 3. PSO-3 Innovation and Research Aptitude:** M.Sc. Biotechnology graduates will display a strong inclination towards research and innovation in the field. They will be capable of formulating research hypotheses, designing experimental protocols, and conducting independent investigations. Graduates will contribute to the development of novel biotechnological approaches, addressing real-world challenges in areas such as agriculture, healthcare, environmental conservation, and industrial bioprocessing.
- 4. PSO-4 Ethical and Regulatory Awareness:** Graduates will exhibit a keen awareness of the ethical and regulatory considerations inherent to biotechnological research and applications. They will understand the implications of their work on society, environment, and human health. Graduates will adhere to responsible research practices, demonstrating a commitment to biosafety, bioethics, and compliance with relevant laws and regulations governing biotechnology.



Course Outcomes (COs)

Course: Sem I Paper 1 Instrumentation and Analytical Techniques:

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

1. **CO-1** Apply basic principles of different analytical techniques in analytical work.
2. **CO-2** Concept of electromagnetic radiation, absorption spectrum, Beer's law and Lamberts law
3. **CO-3** Use spectroscopy, microscopy, centrifugation, electrophoretic techniques and radioactivity in biotechnological applications Demonstrate principle and working of various instruments
4. **CO-4** Use various techniques for solving industrial and research problem

Course: Sem I Paper 2 Fundamentals of Microbiology:

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

1. **CO-1** Get an idea about the historical events in microbiology
2. **CO-2** Understand the diversity in microbiology
3. **CO-3** Know the scope of Microbiology
4. **CO-4** Understand the taxonomic classification of microorganisms
5. **CO-5** Know the general characteristics of Bacteria, fungi, algae and viruses

Course: Sem I Paper 3 Cell Biology and Molecular Genetics:

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

1. **CO-1** The cell organization in prokaryotes: structure and synthesis of bacterial cell wall and other cell organelles or structures present in bacteria. Importance of antibiotics, their mode of action and development of antibiotic resistance.
2. **CO-2** The cell organization in eukaryotes: structure, function and protein transport of membrane, structure and functions of other cell organelles, cytoskeleton, genetic organization and concept of protein targeting.
3. **CO-3** Mitosis and Meiosis. Cell cycle and its regulation. Mechanism and pathways of cell proliferation and apoptosis.
4. **CO-4** Basics of signal transduction. Role of second messengers and protein kinases in signal transduction. Mechanism of Quorum sensing. Production and application of Biofilms.
5. **CO-5** Various methods of gene transfer in bacteria and their mechanism

Course: Sem I Paper 4 Biochemistry:

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

1. **CO-1** Instruments used in microbiology, sterilization techniques etc.
2. **CO-2** Gram staining, culture media preparation and antibiotic susceptibility test.
3. **CO-3** At the end of each biochemical estimation method students will be able to qualitatively and quantitatively determine the level of various test macromolecules in a given sample.



4. **CO-4** Students will also be able to perform comparative estimations of same sample via using different assays i.e., estimation of proteins by Molisch's Test, Fehling's Test and Benedict's test etc.
5. **CO-5** Students will also be able to determine the sensitivity of each method used for single test macromolecule so that the test molecules present in a very low amount can also be estimated using the most sensitive method. Explain typical growth curve of bacteria

Course: Sem II Paper 1 Genetic Engineering:

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

1. **CO-1** Learn about different enzymes used in genetic engineering for DNA manipulations
2. **CO-2** To study different vectors and their characteristics
3. **CO-3** Transformation methods and their use in Genetic Engineering.
4. **CO-4** Determine the selection parameters of r-DNA, creation of different gene libraries. Using genetic engineering for mutagenesis, gene silencing, and amplification of DNA, DNA Sequencing

Course: Sem II Paper 2 Fermentation Technology:

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

1. **CO-1** Microbes involved in fermentation.
2. **CO-2** The basics of fermentation technology.
3. **CO-3** General design of fermented, media and the process of fermentation.
4. **CO-4** Optimization of fermentation process.
5. **CO-5** Use of microbes for production of important industrial products.

Course: Sem II Paper 3 Molecular Biology:

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

1. **CO-1** Understand and describe various concepts – related with gene and its regulation
2. **CO-2** Understand and explain various processes by which gene transfer occurs amongst microbes
3. **CO-3** Explain the causes of gene mutation and their effect on cell
4. **CO-4** Understand and explain the principles, methodology and application of various bio instruments like spectrophotometer, electrophoresis, chromatography, centrifuge etc

Course: Sem II Paper 4 Bioinformatics:

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

1. **CO-1** Basics knowledge of computers, input and output devices, storage devices and different operating systems
2. **CO-2** Different Biological data file formats and Search engines
3. **CO-3** Biological databases Primary nucleotide sequence and Primary Protein sequence databases. Secondary databases, Microbiology databases



4. **CO-4** Sequence analysis like Pair wise Sequence Alignment, Sequence similarity search programs and Substitution matrices.
5. **CO-5** Protein structure prediction: Homology modelling, Primer Designing, Multi-dimensional protein identification technology – identification using database.

Course: Sem III Paper 1 Plant Biotechnology:

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

1. **CO-1** Students will learn the principals and technical advances behind the in vitro culture of plant cells and rDNA techniques
2. **CO-2** Students will learn the applications of plant transformation for improving the productivity and performance of plants under biotic and abiotic stresses
3. **CO-3** Students will understand the use of antisense technologies for improvement of crop plants
4. **CO-4** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to plant biotechnology.
5. **CO-5** Students will have a clear understanding of ethical issues related to plant biotechnology and be able to apply ethical principles in their work.

Course: Sem III Paper 2 Animal Biotechnology:

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

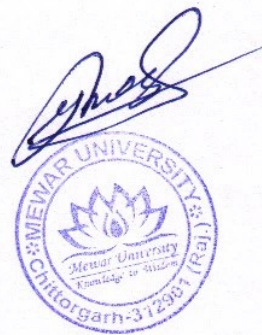
1. **CO-1** Students will understand the structure of animal genes and genomes.
2. **CO-2** Students will understand how genes are expressed and what regulatory mechanisms contribute to control of gene expression.
3. **CO-3** Students will understand basic principles and techniques in genetic manipulation and genetic engineering.
4. **CO-4** Students will understand gene transfer technologies for animals and animal cell lines.
5. **CO-5** Students will understand the techniques and problems both technical and ethical in animal cloning.

Course Outcomes (COs)

Course: Sem IV Paper 1 Major Research Project:

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

1. **CO-1** To develop synopsis of a defined research problem.
2. **CO-2** To conduct the bench work.
3. **CO-3** To prepare the research report and its oral demonstrations.



MEWAR UNIVERSITY
DEPARTMENT: LIFE SCIENCE
PROGRAMME: M.Sc. BIOCHEMISTRY

Program outcomes (POs)

1. **PO-1 Advanced Knowledge:** Graduates will possess a deep and comprehensive understanding of the principles, theories, and concepts in biochemistry, enabling them to critically analyze and solve complex biochemical problems.
2. **PO-2 Research Proficiency:** Graduates will be equipped with the skills to design, conduct, and manage independent research projects in various areas of biochemistry, contributing to the advancement of scientific knowledge in the field.
3. **PO-3 Technical Expertise:** Graduates will have gained proficiency in a wide range of laboratory techniques and analytical instruments used in biochemical research, allowing them to perform accurate and reproducible experiments.
4. **PO-4 Interdisciplinary Competence:** Graduates will be adept at integrating knowledge from various scientific disciplines, enabling them to collaborate effectively with researchers from other fields and tackle interdisciplinary challenges.
5. **PO-5 Data Analysis and Interpretation:** Graduates will be skilled in collecting, analyzing, and interpreting complex biological data, including omics data (genomics, proteomics, metabolomics), to derive meaningful insights and draw scientifically sound conclusions.
6. **PO-6 Communication Skills:** Graduates will be able to effectively communicate their research findings through written reports, presentations, and scientific publications, both to fellow researchers and to a broader audience.
7. **PO-7 Ethical Awareness:** Graduates will demonstrate a strong understanding of ethical considerations in biochemistry research, including issues related to data integrity, animal and human subjects' rights, and responsible conduct in scientific practices.
8. **PO-8 Problem-Solving Abilities:** Graduates will be proficient in applying critical thinking and problem-solving skills to address real-world challenges in areas such as drug development, molecular biology, biotechnology, and environmental science.
9. **PO-9 Career Readiness:** Graduates will be well-prepared for diverse career paths, including academia, industry, government, and healthcare, due to their comprehensive knowledge, research experience, and practical skills acquired during the program.



Program Specific Outcomes (PSOs)

1. PSO 1: Advanced Understanding of Biomolecular Principles

Graduates will demonstrate a comprehensive understanding of the fundamental principles of biochemistry, including molecular structure and function of biomolecules, enzymology, metabolism, and genetic regulation at an advanced level. They will be able to critically analyze and apply this knowledge to solve complex biochemical problems.

2. PSO 2: Proficiency in Laboratory Techniques and Experimental Design

Graduates will have gained proficiency in a wide range of laboratory techniques commonly used in biochemical research, such as protein purification, DNA manipulation, spectroscopic analysis, chromatography, and molecular biology methods. They will be capable of designing, executing, and interpreting experiments independently, ensuring accurate and reliable data generation.

3. PSO 3: Application of Biochemical Concepts to Biomedical and Industrial Contexts

Graduates will be able to apply their biochemical knowledge to real-world contexts, including biomedical and industrial settings. They will be equipped to contribute to the development of new drugs, diagnostics, and therapies, as well as the optimization of biotechnological processes. They will understand the ethical, regulatory, and safety considerations associated with these applications.

4. PSO 4: Effective Communication and Interdisciplinary Collaboration

Graduates will possess strong communication skills, both written and oral, allowing them to effectively convey complex biochemical concepts to diverse audiences. They will be adept at collaborating with professionals from various disciplines, recognizing the interdisciplinary nature of biochemistry and its applications. They will be capable of participating in research teams, presenting findings, and engaging in scientific discussions.



Course Outcomes (COs)

Course: Sem I Paper 1 Instrumentation and Analytical Techniques:

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

1. **CO-1** Apply basic principles of different analytical techniques in analytical work.
2. **CO-2** Concept of electromagnetic radiation, absorption spectrum, Beer's law and Lamberts law
3. **CO-3** Use spectroscopy, microscopy, centrifugation, electrophoretic techniques and radioactivity in biotechnological applications Demonstrate principle and working of various instruments
4. **CO-4** Use various techniques for solving industrial and research problem

Course: Sem I Paper 2 Plant Physiology and Biochemistry:

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

1. **CO-1** The students will be introduced to the structure, biosynthesis and mechanism of action of major plant hormones, plant growth regulators, and photoreceptors in higher plants
2. **CO-2** The students will be able to understand the chemical and physical composition and biosynthesis of cellulose and lignin.
3. **CO-3** The students will learn about the secondary plant metabolism, biosynthesis and function of major secondary plant product classes like terpenoids, alkaloids and flavonoids etc.
4. **CO-4** The students will learn about nitrogen metabolism, mechanism of nitrate and nitrite reduction, and fixation of nitrogen.
5. **CO-5** This course will help the students to gain knowledge electron transport in higher plants and its relation with the carbon fixation pathways, Light regulation of photosynthetic enzymes, Calvin cycle, CAM, C4 pathways, and photorespiration.

Course: Sem I Paper 3 Cell Biology and Molecular Genetics:

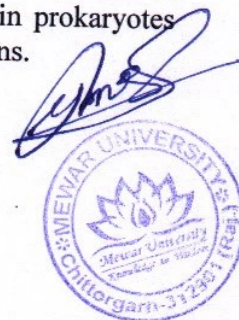
By the end of this course, the students will be able to:

1. **CO-1** The cell organization in prokaryotes: structure and synthesis of bacterial cell wall and other cell organelles or structures present in bacteria. Importance of antibiotics, their mode of action and development of antibiotic resistance.
2. **CO-2** The cell organization in eukaryotes: structure, function and protein transport of membrane, structure and functions of other cell organelles, cytoskeleton, genetic organization and concept of protein targeting.
3. **CO-3** Cell division in eukaryotes i.e., Mitosis and Meiosis. Cell cycle and its regulation. Mechanism and pathways of cell proliferation and apoptosis.
4. **CO-4** Basics of signal transduction. Role of second messengers and protein kinases in signal transduction. Mechanism of Quorum sensing. Production and application of Biofilms.
5. **CO-5** Various methods of gene transfer in bacteria and their mechanism: Transduction, Transformation and Conjugation. Transposons present in prokaryotes and their mechanism of transposition. Types and role of Retrotransposons.

Course: Sem I Paper 4 Fundamentals of Biochemistry:

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

1. **CO-1** Instruments used in microbiology, sterilization techniques etc.



2. **CO-2** Gram staining, culture media preparation and antibiotic susceptibility test.
3. **CO-3** At the end of each biochemical estimation method students will be able to qualitatively and quantitatively determine the level of various test macromolecules in a given sample.
4. **CO-4** Students will also be able to perform comparative estimations of same sample via using different assays i.e., estimation of proteins by Molisch's Test, Fehling's Test and Benedict's test etc.
5. **CO-5** Students will also be able to determine the sensitivity of each method used for single test macromolecule so that the test molecules present in a very low amount can also be estimated using the most sensitive method. Explain typical growth curve of bacteria

Course: Sem II Paper 1 Bioenergetics and Metabolism:

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

1. **CO-1** Learn about different enzymes used in genetic engineering for DNA manipulations
2. **CO-2** To study different vectors and their characteristics
3. **CO-3** Transformation methods and their use in Genetic Engineering.
4. **CO-4** Determine the selection parameters of r-DNA, creation of different gene libraries. Using genetic engineering for mutagenesis, gene silencing, and amplification of DNA, DNA Sequencing

Course: Sem II Paper 2 Molecular Biology:

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

1. **CO-1** Understand and describe various concepts – related with gene and its regulation
2. **CO-2** Understand and explain various processes by which gene transfer occurs amongst microbes
3. **CO-3** Explain the causes of gene mutation and their effect on cell
4. **CO-4** Understand and explain the principles, methodology and application of various bio instruments like spectrophotometer, electrophoresis, chromatography, centrifuge etc

Course: Sem II Paper 3 Enzymology:

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

1. **CO-1** Acquire the knowledge of enzymes their properties and classification, Mechanism of action, Michaelis-Menten initial rate equation, methods for the determination of K_m and V_{max} .
2. **CO-2** Learn about enzyme kinetics, effect of enzymes concentration, pH and temperature on kinetics of enzyme reactions, enzyme inhibition and activation, and Multi substrate enzyme kinetics.
3. **CO-3** Learn different immobilization techniques and Industrial and clinical scope of enzymes.

Course: Sem II Paper 4 Bioinformatics:

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

1. **CO-1** Basics knowledge of computers, input and output devices, storage devices and different operating systems



2. **CO-2** Different Biological data file formats and Search engines
3. **CO-3** Biological databases Primary nucleotide sequence and Primary Protein sequence databases. Secondary databases, Microbiology databases
4. **CO-4** Sequence analysis like Pair wise Sequence Alignment, Sequence similarity search programs and Substitution matrices.
5. **CO-5** Protein structure prediction: Homology modelling, Primer Designing, Multi-dimensional protein identification technology – identification using database.

Course: Sem III Paper 1 Clinical Biochemistry:

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

1. **CO-1** The student will learn and understand the basics of circulatory system including haematopoiesis, homeostasis, and diseases of blood.
2. **CO-2** The student will learn and understand the fundamentals of digestive system.
3. **CO-3** The student will learn and understand the fundamentals of Respiratory system and Neural & chemical regulation of respiration.
4. **CO-4** The course will aid to understand the basics of excretory system like structure of nephron, glomerular filtration, reabsorption and tubular secretion, homeostatic regulation of water and electrolyte.
5. **CO-5** The course will also aid to learn about kidney diseases like uraemia & glomerulonephritis; liver diseases like Jaundice, Hepatitis, Neurological diseases like Epilepsy, Parkinson & Alzheimer's disease.

Course: Sem III Paper 2 Immunology:

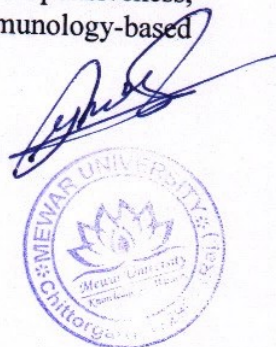
By the end of this course, the students will be able to:

1. **CO-1** Learn the fundamental principles of immune response including molecular, biochemical and cellular basis of immune homeostasis.
2. **CO-2** The course will aid in understanding various aspects of immunological response and how its triggered and regulated.
3. **CO-3** The student will learn and understand the rationale behind various assays used in immune diagnosis of diseases and will be able to transfer knowledge of immunology in clinical perspective.
4. **CO-4** The course will aid in understanding the principles of Graft rejection, Auto immunity and Antibody based therapy.
5. **CO-5** Develop the capacity for problem-solving about immune responsiveness, knowledge of pathogenesis of diseases and designing of immunology-based interventions for effective treatment.

Course: Sem IV Paper 1 Major Research Project:

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

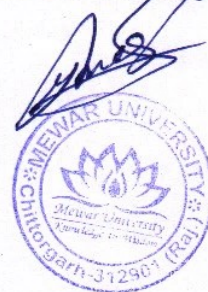
1. **CO-1** To develop synopsis of a defined research problem.
2. **CO-2** To conduct the bench work.
3. **CO-3** To prepare the research report and its oral demonstrations.



MEWAR UNIVERSITY, GANGRAR, CHITTORGARH
DEPARTMENT: LIFE SCIENCE
PROGRAMME: B.Sc. MICROBIOLOGY

Program Outcomes (POs)

1. **PO-1 Demonstrate Foundational Knowledge:** Graduates will possess a solid understanding of the fundamental principles, concepts, and theories in microbiology, including microbial morphology, genetics, physiology, and ecology.
2. **PO-2 Laboratory Proficiency:** Graduates will be proficient in laboratory techniques and methodologies used in microbiology, including culturing, isolation, identification, and characterization of microorganisms.
3. **PO-3 Critical Thinking and Problem Solving:** Graduates will be able to critically analyze complex microbiological problems, propose hypotheses, design experiments, and interpret results to contribute to the advancement of scientific knowledge.
4. **PO-4 Microbial Diversity and Classification:** Graduates will be able to classify and identify various microorganisms, including bacteria, viruses, fungi, and protozoa, and understand their ecological roles and impact on human health and the environment.
5. **PO-5 Infection Control and Public Health:** Graduates will be knowledgeable about the spread, prevention, and control of infectious diseases, and be able to apply microbiological principles to contribute to public health initiatives and disease prevention strategies.
6. **PO-6 Biotechnological Applications:** Graduates will understand the application of microbiology in various biotechnological processes, such as fermentation, genetic engineering, and production of biofuels, pharmaceuticals, and food products.
7. **PO-7 Communication Skills:** Graduates will be able to effectively communicate scientific information, both in written and oral forms, to a variety of audiences, including peers, non-experts, and the general public.
8. **PO-8 Ethical and Professional Conduct:** Graduates will adhere to ethical standards in scientific research and demonstrate professional conduct in laboratory settings, including responsible data management, safety practices, and compliance with regulations.
9. **PO-9 Research and Inquiry:** Graduates will have the ability to engage in independent research, evaluate scientific literature, and contribute to the generation of new knowledge in microbiology through hypothesis-driven investigations.



Program-Specific Outcomes (PSOs)

1. **PSO-1 Microbial Identification and Analysis:** Graduates of the B.Sc. Microbiology program will be able to demonstrate proficiency in identifying and characterizing microorganisms using advanced laboratory techniques, including microscopy, biochemical assays, and molecular methods.
2. **PSO-2 Disease Diagnosis and Control:** Graduates will possess the skills to diagnose and manage microbial infections by applying their knowledge of pathogenic microorganisms, disease mechanisms, and antimicrobial strategies, contributing to the effective control and prevention of infectious diseases.
3. **PSO-3 Biotechnological Applications:** Students will be capable of utilizing microorganisms for various biotechnological applications, such as bioremediation, fermentation, and production of bioactive compounds. They will be able to design and execute experiments, analyze results, and contribute to advancements in biotechnology.
4. **PSO-4 Research and Communication:** Graduates will be equipped to engage in scientific research in microbiology, including experimental design, data collection, statistical analysis, and interpretation. They will also possess effective communication skills, enabling them to present research findings and scientific concepts to both specialized and non-specialized audiences.



Course Outcomes (COs)

Course: Sem I Paper 1 Biochemistry:

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

1. **CO-1** Students will understand the basic concepts and principles of biochemistry, including the structure and function of biological macromolecules such as proteins, carbohydrates, and lipids.
2. **CO-2** Students will be able to explain the basic biochemical processes involved in metabolism, including glycolysis, the citric acid cycle, and oxidative phosphorylation.
3. **CO-3** Students will be able to analyze, interpret and evaluate scientific data and literature related to biochemistry and metabolism.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to biochemistry and metabolism.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to biochemistry and metabolism.

Course: Sem I Paper 2 Cell Biology:

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

1. **CO-1** Students will understand the basic concepts and principles of cell biology, including the structure and function of cellular components such as membranes, cytoskeleton, and organelles.
2. **CO-2** Students will be able to explain the basic processes involved in cell function, such as cell signalling, cell division, and protein synthesis.
3. **CO-3** Students will be able to analyze, interpret and evaluate scientific data and literature related to cell biology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to cell biology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to cell biology.

Course: Sem II Paper 1 Bacteriology:

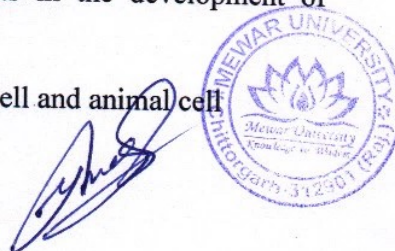
By the end of this course, the students will be able to:

1. **CO-1** Demonstrate Understanding of Bacterial Diversity and Taxonomy
2. **CO-2** Analyze Bacterial Physiology and Metabolism
3. **CO-3** Apply Techniques in Bacterial Cultivation and Identification
4. **CO-4** Evaluate the Role of Bacteria in Human Health and Disease
5. **CO-5** Critically Analyze Current Trends in Bacteriology Research

Course: Sem II Paper 2: Microbial physiology and Metabolism:

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

1. **CO-1** Understand the contributions of eminent scientists in the development of microbiology
2. **CO-2** Understand the ultra-structure of bacterial cell
3. **CO-3** Compare the differences in bacterial cell with plant cell and animal cell



4. **CO-4** Classify the bacteria on the basis of various parameters.
5. **CO-5** Understand the basic nutritional requirements of bacteria

Course: Sem III Paper 1 Virology:

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

1. **CO-1** Virus architecture and nomenclature
2. **CO-2** Virus replication cycles
3. **CO-3** Mechanisms of viral entry and spread of infection
4. **CO-4** Host responses to viral infections
5. **CO-5** Laboratory research and diagnosis of viral diseases

Course: Sem III Paper 2 Instrumentation and Biotechniques:

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

1. **CO-1** Understand and explain the principles, methodology and application of various bio instruments like spectrophotometer, electrophoresis, chromatography, centrifuge etc
2. **CO-2** Understand and explain basic principles and different kinds of microscope
3. **CO-3** Explain the process of different staining techniques
4. **CO-4** Understand and compare various types of stains and dyes
5. **CO-5** Analyse the determination of specific nutrients by bacteria

Course: Sem III Paper 3 Molecular Biology:

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

1. **CO-1** Understand and describe various concepts – related with gene and its regulation
2. **CO-2** Understand and explain various processes by which gene transfer occurs amongst microbes
3. **CO-4** Explain the causes of gene mutation and their effect on cell
4. **CO-5** Understand and explain the principles, methodology and application of various bio instruments like spectrophotometer, electrophoresis, chromatography, centrifuge etc

Course: Sem IV Paper 1 Microbial Genetics:

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

1. **CO-1** Explain the processes behind mutations and other genetic changes
2. **CO-2** Identify and distinguish genetic regulatory mechanisms at different levels
3. **CO-3** Solve theoretical and practical problems in genetic analysis particularly concerning genetic mapping and strain construction
4. **CO-4** Identify genes and mutations in non-annotated sequence data from databases by means of relevant bioinformatics programs
5. **CO-5** Plan basic experiments in microbial genetics concerned with clarifying phenotypes and their relationship with the genotype



Course: Sem IV Paper 2 Environmental Microbiology:

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

1. **CO-1** Understand and explain the significance of bacteriological analysis of drinking water
2. **CO-2** Understand and describe various methods applied for treatment of water and waste water
3. **CO-3** Explain the methods for disposal of industrial wastes
4. **CO-4** Understand the role of microbes of soil in various important processes
5. **CO-5** Describe and explain the applications of bacteria and fungi in bio fertilizers

Course: Sem IV Paper 3 Food and Dairy Microbiology:

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

1. **CO-1** Understand the Microbial Analysis Techniques
2. **CO-2** Understand about Foodborne Pathogens and Safety
3. **CO-3** Gain knowledge about Fermentation and Bioprocessing
4. **CO-4** Understand the process of Quality Control and Assurance
5. **CO-5** Develop the knowledge of Emerging Trends in Food and Dairy Microbiology

Course: Sem V Paper 1 Industrial Microbiology:

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

1. **CO-1** Understand and describe scope of industrial microbiology
2. **CO-2** Understand and operate fermenters in various industries
3. **CO-3** Explain the process of commercial production and ethanol Vitamin B2 Beer, Wine Penicillin etc.
4. **CO-4** Perform the methods and harvesting and product recovery in industrial fermentations
5. **CO-5** Work out the maintenance of ferment or plant.

Course: Sem V Paper 2 Immunology:

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

1. **CO-1** Understand and describe human body's resistance mechanism against disease
2. **CO-2** Understand and write the role of human body's various organs in natural resistance.
3. **CO-3** Understand the properties, structure and importance of antibiotics in immunity
4. **CO-4** Understand various mechanism by which antibiotic destroys antigens
5. **CO-5** Describe and explain the reasons, classes and development of allergy in humans.

Course: Sem VI Paper 1 Medical Microbiology:

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

1. **CO-1** Understand and explain the stages of infectious diseases
2. **CO-2** Describe various modes by which infections spread in community

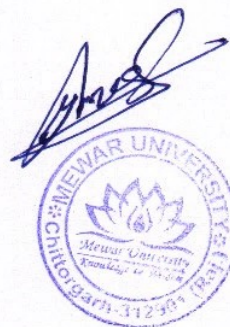


3. **CO-3** Describe various methods that can be adopted to control spread of infection in community
4. **CO-4** Understand and explain various hospital borne, air borne and water-borne diseases
5. **CO-5** Understand how to educate the people about taking care of health

Course: Sem VI Paper 2 Recombinant DNA Technology:

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

1. **CO-1** Understand the tools and techniques of genetic engineering
2. **CO-2** Understand and describe DNA, fingerprinting and its application in forensic science
3. **CO-3** Understand the methods of production of health-related compounds by biotechnology
4. **CO-4** Understand and write application of biotechnology in agriculture
5. **CO-5** Explain and describe the advantages /disadvantages of genetic engineering for humans



MEWAR UNIVERSITY, GANGRAR, CHITTORGARH
DEPARTMENT: LIFE SCIENCE
PROGRAMME: B.Sc. BIOTECHNOLOGY

Program outcomes (POs)

1. **PO-1 Lab Proficiency:** Graduates will demonstrate proficiency in using advanced laboratory techniques and equipment commonly used in biotechnology research and development.
2. **PO-2 Research Skills:** Graduates will possess the ability to design, conduct, and analyze experiments, fostering their skills in critical thinking, data interpretation, and hypothesis formulation.
3. **PO-3 Biological Knowledge:** Graduates will have a deep understanding of fundamental biological concepts, including genetics, molecular biology, microbiology, and cell biology, enabling them to apply this knowledge to various biotechnological applications.
4. **PO-4 Ethical Awareness:** Graduates will be equipped with a strong understanding of ethical considerations and regulatory frameworks surrounding biotechnology, enabling them to engage in responsible decision-making within the field.
5. **PO-5 Bioinformatics Proficiency:** Graduates will be skilled in utilizing bioinformatics tools to analyze and interpret complex biological data, contributing to advancements in genomics, proteomics, and computational biology.
6. **PO-6 Bioprocess Management:** Graduates will be capable of designing, optimizing, and managing bioprocesses for the production of biopharmaceuticals, enzymes, biofuels, and other bio-based products.
7. **PO-7 Communication Skills:** Graduates will effectively communicate scientific concepts to diverse audiences, including fellow researchers, non-experts, and the general public, facilitating knowledge dissemination and collaboration.
8. **PO-8 Entrepreneurial Mindset:** Graduates will be equipped with the knowledge and skills to identify market opportunities, create business plans, and navigate the commercial aspects of biotechnology, fostering innovation and entrepreneurship.
9. **PO-9 Collaborative Abilities:** Graduates will demonstrate the ability to work effectively in multidisciplinary teams, collaborating with professionals from various backgrounds such as biology, chemistry, engineering, and medicine, to address complex challenges in biotechnology.



Program-Specific Outcomes (PSOs)

- 1. PSO-1 Laboratory Proficiency:** Graduates will be proficient in applying a wide range of laboratory techniques and methods commonly used in biotechnology research and industry. They will be able to design, execute, and analyze experiments involving genetic engineering, cell culture, molecular biology, and bioinformatics, demonstrating a strong grasp of laboratory safety protocols and quality control measures.
- 2. PSO-2 Biotechnological Innovation:** Graduates will possess the ability to think critically and creatively to develop innovative solutions in biotechnology. They will be able to apply their knowledge of biological systems, genetics, and molecular biology to address challenges in areas such as healthcare, agriculture, and environmental sustainability, contributing to the advancement of novel biotechnological applications.
- 3. PSO-3 Ethical and Regulatory Awareness:** Graduates will understand the ethical, legal, and regulatory considerations associated with biotechnology practices. They will be able to identify and address potential ethical dilemmas related to genetic manipulation, biosecurity, intellectual property, and patient rights.
- 4. PSO-4 Effective Communication and Collaboration:** Graduates will possess strong communication skills, both written and oral, enabling them to effectively convey complex scientific concepts to diverse audiences. They will be capable of collaborating within multidisciplinary teams, bridging the gap between scientists, engineers, and business professionals.



Course Outcomes (COs)

Course: Sem I Paper 1 Biochemistry & Metabolism:

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

1. **CO-1** Students will understand the basic concepts and principles of biochemistry, including the structure and function of biological macromolecules such as proteins, carbohydrates, and lipids.
2. **CO-2** Students will be able to explain the basic biochemical processes involved in metabolism, including glycolysis, the citric acid cycle, and oxidative phosphorylation.
3. **CO-3** Students will be able to analyze, interpret and evaluate scientific data and literature related to biochemistry and metabolism.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to biochemistry and metabolism.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to biochemistry and metabolism.

Course: Sem I Paper 2 Cell Biology:

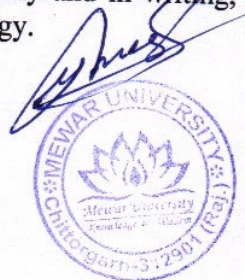
By the end of this course, the students will be able to:

1. **CO-1** Students will understand the basic concepts and principles of cell biology, including the structure and function of cellular components such as membranes, cytoskeleton, and organelles.
2. **CO-2** Students will be able to explain the basic processes involved in cell function, such as cell signaling, cell division, and protein synthesis.
3. **CO-3** Students will be able to analyze, interpret and evaluate scientific data and literature related to cell biology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to cell biology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to cell biology.

Course: Sem II Paper 1 General Microbiology:

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

1. **CO-1** Students will understand the basic concepts and principles of microbiology, including the structure and function of microbial cells, classification, and identification of microorganisms.
2. **CO-2** Students will be able to explain the basic processes involved in microbial growth, metabolism, and genetics.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to microbiology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to microbiology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to microbiology.



Course: Sem II Paper 2 Genetics:

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

1. **CO-1** Students will understand the basic concepts and principles of genetics, including the structure and function of DNA, Mendelian inheritance, and genetic variation.
2. **CO-2** Students will be able to explain the basic processes involved in DNA replication, transcription, and translation.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to genetics.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to genetics.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to genetics.

Course: Sem III Paper 1 Molecular Biology:

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

1. **CO-1** Students will understand the basic concepts and principles of molecular biology, including the structure and function of nucleic acids, DNA replication, transcription, and translation.
2. **CO-2** Students will be able to explain the basic processes involved in gene regulation, gene expression, and genetic engineering.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to molecular biology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to molecular biology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to molecular biology.

Course: Sem III Paper 2 Bio Analytical Tools:

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

1. **CO-1** Students will understand the basic concepts and principles of analytical chemistry and its applications in biological systems.
2. **CO-2** Students will be able to explain the principles and use of various bioanalytical tools, such as chromatography, electrophoresis, mass spectrometry, and spectroscopy.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to bioanalytical tools.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to bioanalytical tools.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to bioanalytical tools.



Course: Sem III Paper 3 Recombinant DNA Technology:

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

1. **CO-1** Students will understand the basic concepts and principles of recombinant DNA technology, including DNA cloning, gene expression, and genetic engineering.
2. **CO-2** Students will be able to explain the principles and use of various molecular biology techniques, such as PCR, gel electrophoresis, and DNA sequencing.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to recombinant DNA technology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to recombinant DNA technology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to recombinant DNA technology.

Course: Sem IV Paper 1 Immunology:

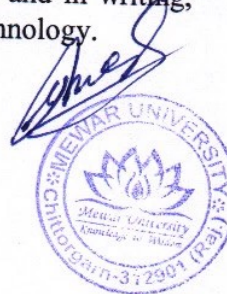
By the end of this course, the students will be able to:

1. **CO-1** Students will understand the basic concepts and principles of immunology, including the structure and function of the immune system, immunological techniques, and immune responses to different antigens.
2. **CO-2** Students will be able to explain the principles and use of various immunological techniques, such as ELISA, western blotting, flow cytometry, and immunohistochemistry.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to immunology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to immunology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to immunology.

Course: Sem IV Paper 2 Bioprocess Technology:

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

1. **CO-1** Students will understand the basic concepts and principles of bioprocess technology, including the design, operation, and optimization of bioreactors for production of biomolecules.
2. **CO-2** Students will be able to explain the principles and use of various bioprocessing techniques, such as fermentation, downstream processing, and process analytics.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to bioprocess technology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to bioprocess technology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to bioprocess technology.



Course: Sem IV Paper 3 Environmental Biotechnology:

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

1. **CO-1** Students will understand the basic concepts and principles of environmental biotechnology, including the application of biotechnology to solve environmental problems.
2. **CO-2** Students will be able to explain the principles and use of various environmental biotechnologies, such as bioremediation, phytoremediation, and bioaugmentation.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to environmental biotechnology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to environmental biotechnology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to environmental biotechnology.

Course: Sem V Paper 1 Plant Biotechnology:

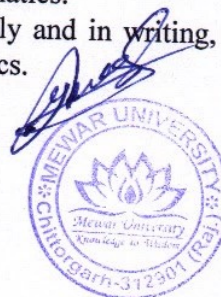
By the end of this course, the students will be able to:

1. **CO-1** Students will understand the basic concepts and principles of plant biotechnology, including the techniques used for genetic modification, tissue culture, and gene expression analysis in plants.
2. **CO-2** Students will be able to explain the principles and use of various plant biotechnologies, such as genetic engineering, plant tissue culture, and plant transformation.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to plant biotechnology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to plant biotechnology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to plant biotechnology.

Course: Sem V Paper 2 Bioinformatics:

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

1. **CO-1** Students will understand the basic concepts and principles of bioinformatics, including the use of computer programming and statistical analysis to process and analyze biological data.
2. **CO-2** Students will be able to explain the principles and use of various bioinformatics tools and software, such as sequence alignment, gene expression analysis, and protein structure prediction.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to bioinformatics.
4. **CO-4** Students will be able to design experiments, conduct bioinformatics analyses, and apply appropriate statistical analyses to data related to bioinformatics.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to bioinformatics.



Course: Sem VI Paper 1 Animal Biotechnology:

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

1. **CO-1** Students will understand the basic concepts and principles of animal biotechnology, including the techniques used for genetic modification, reproductive biotechnology, and gene expression analysis in animals.
2. **CO-2** Students will be able to explain the principles and use of various animal biotechnologies, such as transgenic animal production, cloning, and genome editing.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to animal biotechnology.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to animal biotechnology.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to animal biotechnology.

Course: Sem VI Paper 2 Genomics and Proteomics:

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

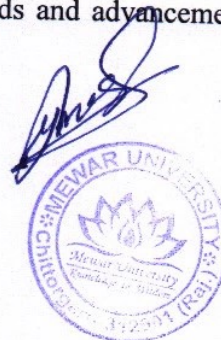
1. **CO-1** Students will understand the basic concepts and principles of genomics and proteomics, including the techniques used for studying gene expression, protein function, and regulation in cells and organisms.
2. **CO-2** Students will be able to explain the principles and use of various genomic and proteomic tools and technologies, such as DNA sequencing, microarray analysis, and mass spectrometry.
3. **CO-3** Students will be able to analyze, interpret, and evaluate scientific data and literature related to genomics and proteomics.
4. **CO-4** Students will be able to design experiments, conduct laboratory work, and apply appropriate statistical analyses to data related to genomics and proteomics.
5. **CO-5** Students will be able to communicate effectively, both orally and in writing, about scientific concepts and research results related to genomics and proteomics.



MEWAR UNIVERSITY, GANGRAR, CHITTORGARH
DEPARTMENT: LIFE SCIENCE
PROGRAMME: B.Sc. GENERAL (BCZ)

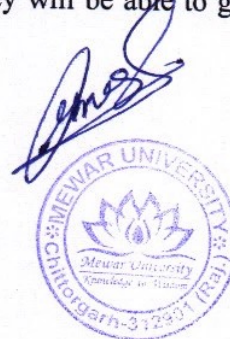
Program outcomes (POs)

1. **PO-1 Foundational Knowledge:** Graduates will demonstrate a strong understanding of fundamental principles, theories, and concepts in their chosen field of science.
2. **PO-2 Critical Thinking:** Graduates will be skilled in analyzing complex problems, evaluating evidence, and forming logical arguments, fostering their ability to make informed decisions and solve scientific challenges.
3. **PO-3 Research Skills:** Graduates will possess the ability to plan, conduct, and communicate results of scientific research using appropriate methodologies, tools, and techniques.
4. **PO-4 Communication Skills:** Graduates will be proficient in effectively conveying scientific information, both in written and oral forms, to diverse audiences including peers, experts, and the general public.
5. **PO-5 Quantitative Literacy:** Graduates will demonstrate competence in using quantitative methods, data analysis, and mathematical reasoning to interpret and draw conclusions from scientific data.
6. **PO-6 Interdisciplinary Awareness:** Graduates will recognize the interconnectedness of different scientific disciplines and be able to collaborate across fields to address complex challenges that require multidisciplinary approaches.
7. **PO-7 Ethical and Professional Responsibility:** Graduates will understand and adhere to ethical standards and professional practices in science, showing awareness of the societal and environmental implications of their work.
8. **PO-8 Technological Proficiency:** Graduates will be familiar with modern scientific tools, equipment, and technology, and be capable of adapting to new technological advancements in their field.
9. **PO-9 Lifelong Learning:** Graduates will recognize the importance of continuous learning and professional development, staying up-to-date with current trends and advancements in the sciences throughout their careers.



Program-specific outcomes (PSOs)

1. **PSO-1Laboratory Proficiency:** Graduates of the B.Sc. program will be proficient in conducting laboratory experiments, utilizing a range of scientific equipment, techniques, and methodologies. They will be able to design experiments, collect data, analyze results, and draw meaningful conclusions.
2. **PSO-2Scientific Communication:** Graduates will possess effective communication skills, enabling them to articulate complex scientific concepts both in written and oral forms. They will be able to present their findings clearly to both technical and non-technical person.
3. **PSO-3Interdisciplinary Problem Solving:** B.Sc. graduates will be adept at integrating knowledge from various scientific disciplines to solve complex problems. They will have the ability to identify connections between different fields of science.
4. **PSO-4 Data Analysis and Interpretation:** Graduates will be proficient in data analysis techniques, including statistical analysis and data visualization. They will be able to gather, organize, and interpret data effectively.



Course Outcomes (COs) (BOTANY)

Course: Sem I Paper 1 Diversity of Microbes, Algae, Fungi and Archegoniate:

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

1. **CO-1** Algae can grow quite well in waste water where other organisms would not survive. Phycologists have developed ways to clean up waste water naturally by using algae.
2. **CO-2** As the course include both fundamental and applied aspects of phycology, the students will be benefitted by both and this can direct them towards research in the field of phycology.
3. **CO-3** Microbiology is one of the most vital fields hence studying microbiology will make the students skilful in understanding the basic concept if role of microorganisms in several industries.
4. **CO-4** Bryophytes, Pteridophytes and gymnosperm have immense ecological and evolutionary significance. Understanding that will be instrumental for students to understand how adaptation played an important role in transition to land habit.
5. **CO-5** All the groups have tremendous economic importance as well in form of availability of tannins, resin, gum etc and other economically important products produced by these group of plants. Knowledge about the economic aspect of these groups of plants will be important.

Course: Sem II Paper 1 Plant Taxonomy and Ecology:

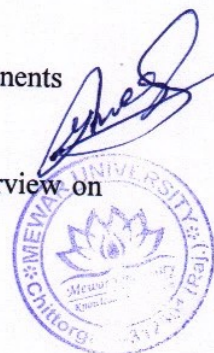
By the end of this course, the students will be able to:

1. **CO-1** While studying plant sciences, it is of utmost importance for the students to know how crucial it is to describe different species and how description of each new species is preserved and used for comparison.
2. **CO-2** The course will benefit the students in understanding the rules of nomenclature and also the evolutionary relationship among living organisms.
3. **CO-3** Taxonomy also provides basis for genetic analysis are performed on the basis of systematic. Hence students with a general idea of taxonomy can interconnect other aspects of biology.

Course: Sem III Paper 1 Plant Anatomy and Embryology:

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

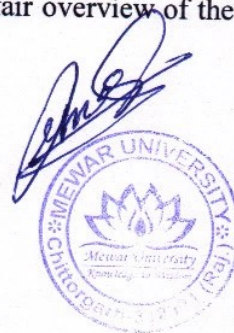
1. **CO-1** The anatomy and ecological significance of different types of tissues
2. **CO-2** The taxonomic and evolutionary variation in xylem and phloem components
3. **CO-3** Anatomical adaptation of plants associated with specific habitats.
4. **CO-4** Understanding the process of woody secondary growth in stems
5. **CO-5** The detailed study regarding the scope of anatomy gives a vast overview on wood technology, archaeology, forensics, and palaeontology.



Course: Sem IV Paper 1 Plant Physiology and Metabolism:

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

1. **CO-1** Study of plant physiology provides the students with the basic idea that we can observe the activities of plants with relation to their external environmental conditions such as heat, drought, cold etc.
2. **CO-2** Physiological studies generate important information useful in field of agronomy, horticulture, genetics and plant breeding.
3. **CO-3** Plant physiology is relevant to number of industries, including food, beverage, pharmaceuticals and textile industries.
4. **CO-4** The students studying plant physiology in depth can get a fair overview of the above-mentioned aspects of it.



Course Outcomes (COs) (ZOOLOGY)

Course: Sem I Paper 1 Animal Diversity & Invertebrates:

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

1. **CO-1** To understand the Animal diversity around us.
2. **CO-2** To understand the underlying principles of classification of animals.
3. **CO-3** To understand the terminology needed in classification.
4. **CO-4** To understand the differences and similarities in the various aspects of classification.
5. **CO-5** To classify invertebrates and to be able to understand the possible group of the invertebrate observed in nature

Course: Sem II Paper 1 Vertebrates:

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

1. **CO-1** Understand comparative account of the different vertebrate systems
2. **CO-2** Understand the pattern of vertebrate evolution, organisation and functions of various systems.
3. **CO-3** Learn the comparative account of integument, skeletal components, their functions and modifications in different vertebrates.
4. **CO-4** Understand the evolution of heart, modification in aortic arches, structure of respiratory organs used in aquatic, terrestrial and aerial vertebrates; and digestive system and its anatomical specializations with respect to different diets and feeding habits.
5. **CO-5** Learn the evolution of brain, sense organs and excretory organs to a complex, highly evolved form in mammals;

Course: Sem III Paper 1 Cytology, Genetics and Evolution:

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

1. **CO-1** Define the basic terms in genetics.
2. **CO-2** Discuss the linkage groups and gene frequency.
3. **CO-3** Explain the concept of mutation.
4. **CO-4** Acquire problem solving and high order analytical skills by attempting numerical problems as well as performing simulation studies of various evolutionary forces in action.
5. **CO-5** Apply knowledge gained, on populations in real time, while studying speciation, behaviour and susceptibility to diseases.

Course: Sem IV Paper 1 Physiology, Biochemistry and Endocrinology:

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

1. **CO-1** Define the basic terms in physiology.
2. **CO-2** Explain the physiological processes in mammals.
3. **CO-3** Explain the anatomy of various systems.
4. **CO-4** Illustrate the reproductive cycles with hormonal control.
5. **CO-5** Diagrammatically represent the working of kidney.