Shiksha Mandal's

Bajaj College of Science, Wardha

(An Autonomous College affiliated to RTM Nagpur University, Nagpur)

Bachelor of Science (B.Sc.) Programme

Programme Outcomes of B.Sc. programme under NEP 2020:

Bajaj College of Science (BCS) offers Bachelor of Science (B.Sc), Master of Science (M.Sc) and Doctor of Philosophy (Ph.D) in three science subjects mainly Chemistry, Botany and Zoology. The B.Sc degree at BCS is a comprehensive, interdisciplinary academic program that builds on existing strength in nine science departments. The BSc offers courses that integrate the material students learn in disciplinary courses such as chemistry, zoology, botany, physics, electronics, mathematics, computer science and biotechnology through practical experiences within academic program. The B.Sc. programme outcomes (POs) at Bajaj College of Science are designed to ensure that graduates possess comprehensive disciplinary expertise, effective communication skills, critical thinking abilities, problem-solving skills, and a strong foundation in ethical practices, preparing them for successful careers and lifelong learning in the scientific field. Here are those:

PO1 - Disciplinary Expertise: Graduates will exhibit an in-depth understanding of core scientific disciplines, such as Chemistry, Botany, Physics, and others. They will integrate knowledge across these fields to solve complex scientific problems, apply theoretical concepts in practical settings, and pursue advanced studies or careers in science with confidence and competence.

PO2 - Communication Skills: Graduates will be adept at articulating scientific concepts clearly and effectively, both in writing and orally. They will tailor their communication style to suit diverse audiences, ranging from experts in the field to the general public, and will use various media and technologies to enhance the clarity and impact of their messages. They will engage in discussions, debates, and presentations with confidence, demonstrating the ability to listen, analyze, and respond thoughtfully.

PO3 - Critical Thinking: Graduates will be capable of rigorous analytical thinking, applying critical evaluation to scientific evidence, arguments, and theories. They will assess the validity of research findings, identify biases or assumptions, and construct well-reasoned arguments. By employing a scientific approach to knowledge development, graduates will contribute to the advancement of their disciplines and make informed decisions in their professional and personal lives.

PO4 - Problem-Solving Skills: Graduates will be skilled in identifying and addressing complex, unfamiliar problems in scientific contexts. They will use their knowledge and experience to formulate creative solutions, adapting their approaches to different challenges. This ability to transfer and apply their learning to real-world situations will prepare them to excel in diverse professional settings, from research laboratories to industry and beyond.

PO5 - Analytical Reasoning: Graduates will possess the ability to critically evaluate scientific data and arguments, identifying logical flaws and gaps in reasoning. They will synthesize information from a variety of sources, draw well-supported conclusions, and present their findings clearly and persuasively. Their analytical reasoning skills will enable them to navigate complex scientific debates and contribute meaningfully to their chosen fields.

PO6 - Research Competency: Graduates will demonstrate strong research skills, including the ability to design and conduct experiments, analyze data, and interpret results. They will be proficient in formulating research questions, developing hypotheses, and using appropriate methodologies to investigate scientific problems. Graduates will also be aware of the ethical considerations in research, ensuring that their work adheres to the highest standards of integrity and transparency.

PO7 - Teamwork and Collaboration: Graduates will excel in collaborative work, effectively contributing to and leading diverse, interdisciplinary teams. They will foster a cooperative environment, facilitating communication and coordination among team members to achieve shared objectives. Their ability to work well with others, both within and outside their field of expertise, will prepare them for successful careers in science, academia, and industry.

PO8 - Scientific Reasoning: Graduates will have a strong foundation in scientific reasoning, enabling them to analyze and interpret both quantitative and qualitative data. They will critically evaluate the validity of scientific ideas, hypotheses, and conclusions, using logical reasoning to assess evidence and make informed decisions. This skill will empower them to tackle complex scientific challenges and contribute to the development of new knowledge.

PO9 - Digital Literacy: Graduates will be proficient in using information and communication technologies (ICT) to support their learning and research. They will demonstrate the ability to access, evaluate, and utilize a wide range of digital resources, including academic databases, scientific journals, and software tools for data analysis. Their digital literacy will enable them to stay current with advancements in their field and to effectively communicate their research findings to a global audience.

PO10 - Ethical Awareness: Graduates will possess a strong sense of ethical responsibility, recognizing the importance of ethical principles in all aspects of their work. They will be equipped to identify and address ethical issues related to their research, avoiding practices such as data fabrication, falsification, plagiarism, and other forms of misconduct. Graduates will also appreciate the broader implications of their work, including its impact on the environment, society, and future generations, and will strive to conduct their research in a manner that is both socially responsible and sustainable.

PO11 - Leadership Qualities: Graduates will demonstrate leadership abilities, including the capacity to set goals, inspire and motivate others, and guide teams toward achieving shared objectives. They will be skilled in strategic planning, decision-making, and resource management, enabling them to lead projects and initiatives in academic, research, and professional settings. Their leadership qualities will prepare them to take on roles of responsibility and influence in their future careers.

PO12 - Lifelong Learning: Graduates will recognize the importance of continuous learning and personal development, staying open to new ideas, technologies, and methodologies in their field. They will actively seek out opportunities for professional growth, whether through further education, training, or self-directed learning. This

commitment to lifelong learning will enable them to adapt to the evolving demands of the scientific landscape and to make meaningful contributions throughout their careers.

Programme specific outcomes of BSc programme under NEP 2020:

Under NEP 2020 regulations, Bajaj College of Science has offered various courses in major and minor format. Major/Core, Minor courses were offered in the following subjects from the academic session 2023-24 as per NEP 2020.

- Botany
- Microbiology
- Chemistry
- Physics
- Electronics
- Zoology
- Mathematics

Besides above-mentioned subjects, Minor courses were also be available in following subjects.

- Biotechnology
- Computer Science

Programme-Specific Outcomes for B.Sc. Major in Botany and Minor in Chemistry:

PSO1- Integrative Understanding of Biological and Chemical Sciences
Acquire a profound understanding of plant sciences, encompassing plant diversity, anatomy, physiology, and metabolism, while integrating core concepts of inorganic, organic, and physical chemistry.
PSO2- Proficiency in Analytical and Experimental Skills
Develop expertise in experimental methodologies such as plant tissue culture, spectroscopy, and chromatography.
PSO3- Foundation for Research, Innovation, and Professional Growth
Build a robust foundation for advanced studies or careers in fields like plant biotechnology, agricultural sciences, environmental chemistry, and pharmacology.

Programme-Specific Outcomes for B.Sc. Major in Botany and Minor in Microbiology

PSO1- Comprehensive Understanding of Plant and Microbial Sciences
Develop an integrative knowledge of plant biology and microbial sciences, including plant diversity, anatomy, and physiology, along with microbial morphology, metabolism, and their roles in industrial, medical, and environmental applications.
PSO2- Proficiency in Laboratory and Analytical Techniques
Attain hands-on expertise in advanced laboratory techniques such as microbial culturing, enzymology, bioinstrumentation, and plant tissue culture.
PSO3- Foundation for Research and Societal Contributions
Build a strong foundation for advanced studies or careers in plant sciences, microbiology, and allied fields such as agricultural microbiology, medical microbiology, and environmental biotechnology.

Programme-Specific Outcomes for B.Sc. Major in Botany and Minor in Zoology

PSO1- Integrated Knowledge of Plant and Animal Sciences

Cultivate a comprehensive understanding of plant biology, including plant diversity, anatomy, physiology, and systematics, alongside a foundational knowledge of animal biology, covering the diversity of non-chordates and chordates, cell biology, genetics, molecular biology, and ethology.

PSO2- Skill Development in Multidisciplinary Techniques

Develop proficiency in experimental methods across botany and zoology, including plant tissue culture, genetic analysis, molecular biology techniques, and ethological studies.

PSO3- Preparation for Research and Professional Excellence

Establish a solid foundation for advanced studies or careers in botany, zoology, and interdisciplinary fields such as ecology, conservation biology, and environmental sciences.

Programme-Specific Outcomes for B.Sc. Major in Botany and Minor in Biotechnology

PSO1- Comprehensive Knowledge of Plant Sciences and Biotechnology

Develop a profound understanding of plant biology, encompassing plant diversity, anatomy, physiology, and metabolism, integrated with the fundamentals of biotechnology, including biomolecules, microbiology, molecular biology, and recombinant DNA technology.

PSO2- Proficiency in Biotechnological and Botanical Techniques

Attain hands-on expertise in experimental methods such as plant tissue culture, microbial analysis, enzymology, and recombinant DNA technology.

PSO3- Preparation for Innovation and Career Advancement

Build a robust foundation for advanced studies or careers in fields such as plant biotechnology, genetic engineering, molecular biology, and agricultural innovation.

Programme-Specific Outcomes for B.Sc. Major in Microbiology and Minor in Botany

PSO1- Integrated Expertise in Microbiology and Plant Sciences

Acquire a deep understanding of microbial sciences, including microbial morphology, techniques, metabolism, molecular biology, and biotechnology, complemented by foundational knowledge of plant biology, covering plant diversity, physiology, and ecology.

PSO2- Proficiency in Experimental and Analytical Techniques

Develop advanced laboratory skills in microbial techniques, enzymology, bioinstrumentation, and molecular biology, alongside expertise in plant tissue culture and ecological studies.

PSO3- Foundation for Research and Multidisciplinary Careers

Build a strong foundation for higher education or careers in fields such as microbial biotechnology, plant-microbe interactions, sustainable agriculture, and environmental conservation.

Programme-Specific Outcomes for B.Sc. Major in Microbiology and Minor in Zoology

PSO1- Comprehensive Understanding of Microbial and Animal Sciences

Develop an in-depth understanding of microbial sciences, including microbial morphology, metabolism, molecular biology, and biotechnology, integrated with

foundational knowledge of zoology, covering non-chordates, chordates, genetics, and molecular biology.

PSO2- Proficiency in Laboratory and Analytical Skills

Gain hands-on expertise in microbiological techniques, enzymology, recombinant DNA technology, and immunology, complemented by skills in animal dissection, cell biology, and ethological studies.

PSO3- Preparation for Advanced Research and Professional Growth

Establish a strong foundation for higher education or careers in microbiology, zoology, or interdisciplinary fields such as medical microbiology, immunology, wildlife conservation, and environmental biotechnology.

Programme-Specific Outcomes for B.Sc. Major in Microbiology and Minor in Biotechnology

PSO1- Comprehensive Knowledge of Microbial and Biotechnological Sciences

Acquire a deep understanding of microbial sciences, including microbial morphology, metabolism, immunology, and molecular biology, integrated with core concepts of biotechnology, such as biomolecules, cell biology, recombinant DNA technology, and bioinformatics.

PSO2- Proficiency in Advanced Laboratory Techniques

Develop hands-on expertise in microbiological methods, enzymology, molecular biology, and immunological assays, complemented by skills in genetic engineering, rDNA technology, and bioinstrumentation.

PSO3- Preparation for Research and Industry-Driven Careers

Build a strong foundation for higher education or careers in microbiology, biotechnology, or interdisciplinary fields such as microbial biotechnology, biopharmaceuticals, and environmental biotechnology.

Programme-Specific Outcomes for B.Sc. Major in Chemistry and Minor in Botany

PSO1- Integrated Knowledge of Chemical and Plant Sciences

Develop a robust understanding of chemistry, encompassing inorganic, organic, and physical chemistry principles, alongside foundational knowledge in plant sciences, including plant diversity, physiology, and ecology.

PSO2- Proficiency in Analytical and Experimental Skills

Gain hands-on expertise in chemical techniques such as spectroscopy, chromatography, and synthesis, combined with botanical skills such as plant tissue culture, ecological analysis, and anatomical studies.

PSO3- Preparation for Multidisciplinary Careers and Research

Establish a strong foundation for advanced studies or careers in chemistry, botany, or interdisciplinary fields such as agricultural chemistry, environmental science, and natural product research.

Programme-Specific Outcomes for B.Sc. Major in Chemistry and Minor in Zoology

PSO1- Comprehensive Knowledge of Chemical and Animal Sciences

Build a strong foundation in chemistry, covering key concepts of inorganic, organic, and physical chemistry, alongside fundamental zoological topics such as non-chordate and chordate biology, genetics, and molecular biology.

PSO2- Proficiency in Laboratory Techniques and Analytical Skills

Develop hands-on expertise in chemical methods such as spectroscopy, synthesis, and chromatography, paired with zoological skills in dissection, cell biology, and behavioural studies.

PSO3- Preparation for Diverse Career and Research Opportunities

Establish a strong foundation for advanced studies or careers in chemistry, zoology, or interdisciplinary fields such as biochemistry, pharmacology, environmental toxicology, and wildlife conservation.

Programme-Specific Outcomes for B.Sc. Major in Chemistry and Minor in Biotechnology

PSO1- Comprehensive Understanding of Chemical and Biotechnological Sciences

Acquire a strong foundation in chemistry, encompassing inorganic, organic, and physical chemistry principles, integrated with core biotechnological concepts such as biomolecules, cell biology, molecular biology, and recombinant DNA technology.

PSO2- Proficiency in Analytical and Biotechnological Techniques

Develop advanced laboratory skills in chemical methodologies, including spectroscopy, chromatography, and synthesis, combined with expertise in biotechnological techniques such as genetic engineering, enzymology, and rDNA technology.

PSO3- Preparation for Multidisciplinary Careers and Research

Build a solid foundation for careers or advanced studies in chemistry, biotechnology, or interdisciplinary fields such as biopharmaceuticals, environmental biotechnology, and industrial chemistry.

Programme-Specific Outcomes for B.Sc. Major in Chemistry and Minor in Microbiology

PSO1- Integrated Knowledge of Chemical and Microbial Sciences

Develop a comprehensive understanding of chemistry, covering inorganic, organic, and physical chemistry principles, alongside foundational microbiological concepts such as microbial morphology, metabolism, immunology, and molecular biology.

PSO2- Proficiency in Analytical and Microbiological Techniques

Gain expertise in chemical techniques such as spectroscopy, chromatography, and chemical synthesis, complemented by microbiological skills including microbial culture techniques, enzymology, immunological assays, and rDNA technology.

PSO3- Preparation for Advanced Research and Career Opportunities

Establish a robust foundation for careers or higher studies in chemistry, microbiology, or interdisciplinary fields such as pharmaceutical chemistry, industrial microbiology, and environmental biotechnology.

Programme-Specific Outcomes for B.Sc. Major in Chemistry and Minor in Physics

PSO1- Interdisciplinary Mastery of Chemical and Physical Sciences

Gain an in-depth understanding of chemistry, including inorganic, organic, and physical principles, alongside foundational physics concepts such as mechanics, electricity and magnetism, optics, and thermal physics.

PSO2- Proficiency in Analytical and Experimental Techniques

Develop advanced skills in chemical methodologies such as spectroscopy, chromatography, and synthesis, paired with physics techniques including experimental mechanics, optical instrumentation, and thermal measurements.

PSO3- Preparation for Research and Career Advancement

Build a strong foundation for careers or higher studies in chemistry, physics, or interdisciplinary fields like chemical physics, material sciences, and energy systems.

Programme-Specific Outcomes for B.Sc. Major in Chemistry and Minor in Mathematics

PSO1- Comprehensive Understanding of Chemical and Mathematical Principles

Develop a strong grasp of core chemical concepts, including inorganic, organic, and physical chemistry, while acquiring essential mathematical skills in algebra, calculus, vector analysis, and differential equations.

PSO2- Proficiency in Quantitative Analysis and Problem-Solving

Acquire the ability to apply mathematical methods such as integral calculus, differential equations, and vector analysis to chemical processes and phenomena.

PSO3- Preparation for Advanced Research and Interdisciplinary Careers

Equip students for advanced studies or careers in chemistry, applied mathematics, and interdisciplinary fields like computational chemistry, chemical engineering, and data science.

Programme-Specific Outcomes for B.Sc. Major in Zoology and Minor in Botany

PSO1- Comprehensive Knowledge of Animal and Plant Sciences

Develop a strong foundation in zoology, encompassing topics such as non-chordate and chordate biology, genetics, and molecular biology, while gaining complementary insights into plant diversity, physiology, and ecology.

PSO2- Proficiency in Analytical and Observational Skills

Acquire hands-on expertise in zoological techniques such as anatomical dissections, behavioral studies, and cellular analyses, paired with botanical skills including plant anatomical studies, ecological sampling, and tissue culture.

PSO3- Preparation for Interdisciplinary Research and Careers

Build a robust foundation for advanced studies or careers in zoology, botany, or interdisciplinary fields such as wildlife conservation, ecological restoration, and sustainable agriculture.

Programme-Specific Outcomes for B.Sc. Major in Zoology and Minor in Microbiology

PSO1- Comprehensive Understanding of Animal and Microbial Sciences

Develop an in-depth understanding of zoological topics such as non-chordate and chordate biology, genetics, and molecular biology, alongside fundamental microbiological concepts, including microbial morphology, metabolism, and immunology.

PSO2- Proficiency in Laboratory and Analytical Techniques

Acquire hands-on expertise in zoological methods such as dissection, cellular analysis, and behavioral studies, combined with microbiological techniques like microbial culture, enzymology, and immunological assays.

PSO3- Preparation for Diverse Career and Research Opportunities

Build a strong foundation for advanced studies or careers in zoology, microbiology, or interdisciplinary fields such as medical microbiology, immunology, and environmental biology.

Programme-Specific Outcomes for B.Sc. Major in Zoology and Minor in Chemistry

PSO1- Comprehensive Understanding of Animal and Chemical Sciences

Gain a deep understanding of zoological concepts, including non-chordate and chordate biology, genetics, and molecular biology, while building a strong foundation in chemistry encompassing inorganic, organic, and physical principles.

PSO2- Proficiency in Laboratory Techniques and Analytical Skills

Develop practical expertise in zoological techniques such as anatomical dissection, genetic analysis, and ethological observation, alongside chemical methods like spectroscopy, chromatography, and synthesis.

PSO3- Preparation for Advanced Studies and Diverse Career Paths

Establish a solid foundation for advanced studies or careers in zoology, chemistry, or interdisciplinary fields such as toxicology, pharmacology, and environmental science.

Programme-Specific Outcomes for B.Sc. Major in Zoology and Minor in Biotechnology

PSO1- Integrated Knowledge of Zoological and Biotechnological Sciences

Develop a profound understanding of zoological principles, including non-chordate and chordate biology, genetics, molecular biology, and ethology, integrated with foundational biotechnological concepts such as molecular biology, recombinant DNA technology, and bioinformatics.

PSO2- Proficiency in Zoological and Biotechnological Techniques

Acquire practical skills in zoological methodologies such as dissections, behavioral studies, and genetic analysis, coupled with expertise in biotechnological techniques like enzyme assays, molecular cloning, and DNA manipulation.

PSO3- Preparation for Multidisciplinary Careers and Research Opportunities

Build a strong foundation for careers or advanced studies in zoology, biotechnology, or interdisciplinary fields such as genomics, biomedical research, and environmental biotechnology.

Programme-Specific Outcomes for B.Sc. Major in Physics and Minor in Chemistry

PSO1- Interdisciplinary Mastery of Physics and Chemistry

Develop a comprehensive understanding of core principles in physics, including mechanics, electricity and magnetism, optics, thermal physics, and modern physics, while acquiring foundational chemical knowledge in areas such as inorganic, organic, and physical chemistry.

PSO2- Proficiency in Experimental Techniques and Analytical Tools

Gain hands-on experience in experimental techniques related to both physics and chemistry, including the use of advanced instruments in electricity and magnetism, optics, modern physics, and chemical analysis.

PSO3- Preparation for Research and Diverse Career Paths

Equip students for careers or higher studies in physics, chemistry, and interdisciplinary fields such as materials science, nanotechnology, and chemical physics.

Programme-Specific Outcomes for B.Sc. Major in Physics and Minor in Mathematics

PSO1- Integration of Physics and Mathematical Principles

Develop a strong theoretical foundation in physics, encompassing mechanics, electricity and magnetism, optics, thermal physics, modern physics, and electronics, complemented by advanced mathematical concepts such as calculus, vector analysis, differential equations, and mathematical methods.

PSO2- Analytical and Computational Proficiency

Attain expertise in applying mathematical tools to solve complex physical problems, such as analyzing wave propagation, solving equations of motion, modeling thermodynamic systems, and understanding quantum mechanics.

PSO3- Preparation for Research and Advanced Careers

Build a robust platform for pursuing higher education or careers in physics, mathematics, or interdisciplinary fields such as astrophysics, computational physics, and data science.

Programme-Specific Outcomes for B.Sc. Major in Physics and Minor in Electronics

PSO1- Comprehensive Knowledge of Physics and Electronics
Build a strong understanding of fundamental physics concepts, including mechanics, electricity and magnetism, optics, thermal physics, and modern physics, while mastering essential electronic principles such as analog and digital circuits, operational amplifiers, power supplies, and integrated circuits.

PSO2- Hands-On Proficiency in Electronics Design and Applications
Develop practical skills in designing and analyzing electronic circuits, including digital and analog systems, operational amplifier configurations, and specialized circuits using tools like IC 555 and circuit maker software.

PSO3- Preparation for Technological and Research-Oriented Careers
Equip students with the theoretical and technical expertise to pursue advanced studies or careers in fields such as electronics, telecommunications, instrumentation, and applied physics.

Programme-Specific Outcomes for B.Sc. Major in Physics and Minor in Computer Science

PSO1- Interdisciplinary Mastery of Physics and Computing
Develop a strong theoretical foundation in physics, encompassing mechanics, electromagnetism, optics, thermal physics, and modern electronics, while gaining practical expertise in core computer science topics such as programming in C and C++, data structures, operating systems, and cyber security.

PSO2- Computational Problem-Solving and Systems Design
Acquire the ability to apply computational techniques to model physical systems, analyze experimental data, and simulate real-world phenomena.

PSO3- Preparation for Advanced Studies and Technological Careers
Lay a robust foundation for higher studies or careers in interdisciplinary fields such as computational physics, data analytics, artificial intelligence, and information technology.

Programme-Specific Outcomes for B.Sc. Major in Electronics and Minor in Physics

PSO1- Integrated Knowledge of Electronics and Physical Principles
Develop a robust understanding of electronic circuits, embedded systems, and digital design while grounding this expertise in the principles of mechanics, electromagnetism, and thermal physics. Gain practical skills in operational amplifiers, microprocessor programming, and semiconductor fabrication, complemented by a strong foundation in wave optics, modern physics, and statistical mechanics.

PSO2- Research and Innovation in Emerging Technologies
Acquire the ability to conduct research and innovate in areas such as nanotechnology, signal processing, and advanced materials.

PSO3- Industry Readiness and Problem-Solving Skills
Enhance analytical and problem-solving capabilities to excel in industries such as telecommunications, aerospace, and industrial automation.

Programme-Specific Outcomes for B.Sc. Major in Electronics and Minor in Computer Science

PSO1- Comprehensive Understanding of Electronics and Computational Systems
Attain expertise in electronic circuit design, embedded systems, and microprocessor programming, integrated with foundational and advanced knowledge of programming languages, data structures, and operating systems. Develop the ability to design, simulate, and implement cutting-edge electronic systems using tools like VLSI design and digital electronics, while leveraging computational skills in object-oriented programming, cyber security, and software development.
PSO2- Problem-Solving in Interdisciplinary Domains
Enhance analytical thinking to solve complex real-world problems at the interface of electronics and computer science, such as IoT systems, embedded software design, and automation technologies.
PSO3- Industry and Research Readiness
Build readiness for careers in high-tech industries by acquiring practical skills in control systems, microcontroller programming, and software engineering.

Course outcomes of BSc major in Botany

BSc Botany Semester I : Plant Diversity-I

CO1: Recall the diversity and distribution of microbes, including their ultrastructure and reproductive features. *(Bloom's Level 1: Remembering)*
CO2: Identify the thallus organization, reproduction, and economic significance of Cyanobacteria, Algae, Fungi, and Bryophytes. *(Bloom's Level 1: Remembering)*
CO3: Explain the ecological and economic importance of lower cryptogams. *(Bloom's Level 2: Understanding)*
CO4: Describe the plant diseases caused by microbes and their impact on plant health. *(Bloom's Level 2: Understanding)*

BSc Botany Semester II: Plant Diversity-II

CO1: Recall the diversity, biology, and reproductive structures of pteridophytes, gymnosperms, and angiosperms. *(Bloom's Level 1: Remembering)*
CO2: Identify and describe the process of fossilization and recognize fossil plants. *(Bloom's Level 1: Remembering)*
CO3: Explain the morphological features, types, and modifications of various plant parts. *(Bloom's Level 2: Understanding)*
CO4: Discuss the economic utilization and significance of angiosperms in various industries. *(Bloom's Level 2: Understanding)*

BSc Botany Semester III: Plant Taxonomy, Cell Biology & Genetics

CO1: Recall the origin of angiosperms, principles, and rules of plant nomenclature, along with classification systems. (Bloom's Level 1: Remembering)
CO2: Identify the taxonomic characteristics of major angiosperm families and explain their classification. (Bloom's Level 1: Remembering & Level 2: Understanding)

CO3: Describe the ultrastructure, functions of cell organelles, types of cell division, and assembly of chromosomes. (Bloom's Level 2: Understanding)
CO4: Explain Mendel's laws of inheritance, gene interactions, and the mechanisms of linkage and crossing over. (Bloom's Level 2: Understanding)

BSc Botany Semester IV: Plant Taxonomy, Cell Biology & Genetics

CO1: Recall the types of plant tissues and describe their structure and functions. *(Bloom's Level 1: Remembering)*
CO2: Identify and describe the internal structure of roots, stems, and leaves in dicotyledonous and monocotyledonous plants. *(Bloom's Level 1: Remembering & Level 2: Understanding)*
CO3: Explain the developmental stages of plants from germination to maturity. *(Bloom's Level 2: Understanding)*
CO4: Describe the types of pollination and adaptations of flowers that facilitate pollination. *(Bloom's Level 2: Understanding)*

B.Sc. Part I- Semester I
Major Biotechnology

Title of paper	**Fundamentals of Biotechnology and Biomolecules**

Sr. No.	**Course Objectives**
1	To study the application of Biotechnology, genetic engineering and Nano-technology in various important allied fields.
2	To study the ultrastructure with microscopy and staining techniques, nutrition of prokaryotic cells and viruses
3	To study the chemical structure of nucleic acid, gene, nucleosome, chromosome amino acid and proteins structural level

Sr. No.	**Course Outcomes**
1	Students will be able to discuss and explain application of Biotechnology, Genetic Engineering and Nano-technology in various important allied fields.
2	Students will be able to discuss bacterial morphology and nutrition, classify viruses according to taxonomic system and describe life cycle of viruses.
3	Students will be able to describe various macroscopic techniques and demonstrate various type of staining techniques used for bacteria and fungi.
4	Students will be able to illustrate structure and chemical composition of nucleic acid.

5	Students will be able to describe the structure of gene, nucleosome and chromosome.
6	Students will be able to describe classification of amino acid, various separation technique use for amino acid and illustrate primary, secondary, tertiary and quaternary structure of protein.

B.Sc. Part I- Semester I
Minor Biotechnology

Title of paper	**Fundamentals of Biotechnology and Biomolecules**

Sr. No.	**Course Objectives**
1	To study the application of Biotechnology, genetic engineering and Nano-technology in various important allied fields.
2	To study the ultrastructure with microscopy and staining techniques, nutrition of prokaryotic cells and viruses
3	To study the chemical structure of nucleic acid, gene, nucleosome, chromosome amino acid and proteins structural level

Sr. No.	**Course Outcomes**
1	Students will be able to discuss and explain application of Biotechnology, Genetic Engineering and Nano-technology in various important allied fields.
2	Students will be able to discuss bacterial morphology and nutrition, classify viruses according to taxonomic system and describe life cycle of viruses.
3	Students will be able to describe various macroscopic techniques and demonstrate various type of staining techniques used for bacteria and fungi.
4	Students will be able to illustrate structure and chemical composition of nucleic acid.
5	Students will be able to describe the structure of gene, nucleosome and chromosome.
6	Students will be able to describe classification of amino acid, various separation technique use for amino acid and illustrate primary, secondary, tertiary and quaternary structure of protein.

B.Sc. Part I- Semester II
Major Biotechnology

Title of paper	MICROBIOLOGY, CELL BIOLOGYAND ENZYMOLOGY

Sr. No.	Course Objectives
1	To study the various factors associate with microbial growth, mechanism and factors involve in microbial control
2	To study the structure of carbohydrates, lipids, eukaryotic cell and various type of specialized cell.
3	To study the classification of enzyme, enzyme assay, enzyme kinetics and various factor affecting enzyme activities.

Sr. No.	Course Outcomes
1	Students will be able to discuss various phase of microbial growth curve, classification of microbes on the basis of physical condition and explain various techniques for measurement of microbial growth.
2	Students will be able to discuss various mechanism of cell injury and demonstrate various physical and chemical technique use in microbial control.
3	Students will be able to compare plant and animal cell structure and discuss cytoskeleton, cell cycle and various specialized cell.
4	Student will be able to classify carbohydrates and lipids and describe their structure.
5	Students will be able to explain classification of enzyme and various important types of enzymes.
6	Students will be able to describe enzyme assay, kinetics and identify factor affecting enzymatic activities.

B.Sc. Part I- Semester II
Minor Biotechnology

Title of paper	MICROBIOLOGY, CELL BIOLOGYAND ENZYMOLOGY

Sr. No.	Course Objectives
1	To study the various factors associate with microbial growth, mechanism and factors involve in microbial control
2	To study the structure of carbohydrates, lipids, eukaryotic cell and various type of specialized cell.
3	To study the classification of enzyme, enzyme assay, enzyme kinetics and various factor affecting enzyme activities.

Sr. No.	Course Outcomes

1	Students will be able to discuss various phase of microbial growth curve, classification of microbes on the basis of physical condition and explain various techniques for measurement of microbial growth.
2	Students will be able to discuss various mechanism of cell injury and demonstrate various physical and chemical technique use in microbial control.
3	Students will be able to compare plant and animal cell structure and discuss cytoskeleton, cell cycle and various specialized cell.
4	Student will be able to classify carbohydrates and lipids and describe their structure.
5	Students will be able to explain classification of enzyme and various important types of enzymes.
6	Students will be able to describe enzyme assay, kinetics and identify factor affecting enzymatic activities.

B.Sc. Part I- Semester III

Title of paper	METABOLISM AND BIOPHYSICAL TECHNIQUES- I

Sr. No.	**Course Objectives**
1	To study the concept of bioenergetics and major pathways of carbohydrates and lipid metabolism
2	To study the major pathway of metabolism of nitrogenous compound and physiologically important chemical reactions.
3	To study the spectrophotometry, IR and Mass Spectrometry and Spectrofluorometry, type of chromatography techniques

Sr. No.	**Course Outcomes**
1	Students will be able to discuss concept of bioenergetics and illustrate major pathways of carbohydrates metabolism and their regulations.
2	Students will be able to describe major pathways of lipids metabolism and explain disorder related to lipid metabolism.
3	Students will be able to explain major pathways of metabolism of nitrogenous compound, discuss disorder associated with metabolic pathway and will discuss physiologically important product of transmethylation and decarboxylation.
4	Students will be able to discuss concept of electromagnetic radiation, absorption spectrum, Beer's law and describe difference between spectrophotometer and colorimeter, double beam spectrometer and dual wavelength spectrometer.

5	Students will be able to discuss principle, instrumentation and application of IR, Mass and Spectrofluorometry.
6	Students will be able to demonstrate and explain principle and application of paper, thin layer, gel filtration, affinity, ion exchange and high pressure liquid chromatography

B.Sc. Part I- Semester IV

Title of paper	IMMUNOLOGY AND BIOPHYSICAL TECHNIQUES- II

Sr. No.	**Course Objectives**
1	To study the components of immune system, antigen, humoral, cell mediated immunity.
2	To study the various type of hypersensitivity, immunological techniques and hybridoma technology.
3	To study the electrophoresis, SDS Page, pulse-field electrophoresis, centrifugations and isotopic tracer techniques.

Sr. No.	**Course Outcomes**
1	Students will be able to discuss cell and organs of immunity, types of immunity, concept of antigen, complement systems and explain principle and significance of vaccination.
2	Students will be able to explain components of humoral and cell mediated immunity and describe various type of hypersensitivity.
3	Students will be able to demonstrate immunological techniques and discuss application of hybridoma technology.
4	Student will be able to discuss and demonstrate paper electrophoresis, high voltage electrophoresis and gel electrophoresis.
5	Students will be able to describe principle, procedure and application of SDS Page, pulse-field electrophoresis and centrifugations.
6	Student will be able to explain isotopic tracer techniques and its application.

B.Sc. Part I- Semester I
VSEC (VSC-I)
Laboratory Safety and Instrument Handling

Sr. No.	**Course Objectives**
1	To study the laboratory safety and instrument handling
2	To study the accuracy in calculations and in scientific writing

3	To study the responsibilities associated with working in a laboratory.

Sr. No.	**Course Outcomes**
1	Student will be able to explain basic working differences between various laboratories.
2	Students will be able to describe basic instruments used in Biotechnology laboratories
3	Students will be able to behave more professionally in laboratory

B.Sc. Part I- Semester II
Skill Enhancement Course (SEC)
Microbial Commercial Product

Sr. No.	**Course Objectives**
1	To study the microbes are valuable for betterment of mankind.
2	To study the various commercial products produced by microbes.
3	To study the responsibilities associated with working in a microbial laboratory.

Sr. No.	**Course Outcomes**
1	Students will be able to describe production process of microbial commercial products.
2	Students will be able to describe calibration of instruments used in microbiology laboratories/ industries.
3	Students will be able to behave more professionally in laboratory.

B.Sc. Part I- Semester III
Skill Enhancement Course (SEC)
Basic Techniques in Molecular Biology

Sr. No.	**Course Objectives**
1	To study the laboratory safety and instrument handling in molecular biology laboratory
2	To study the basic of bioinformatics experiments.
3	To study the responsibilities associated with molecular biology and r-DNA product manufacturing.

Sr. No.	Course Outcomes
1	Students will be able to describe process of DNA and RNA isolation from various types of cells.
2	Students will be able to understand basic of various bioinformatics techniques
3	Students will be able to explain process of manufacturing of molecular biology and r-DNA Products.

B.Sc. Semester- I and III
Generic Elective Course I (GE I)
Wild Vegetable Diversity of Wardha District

Sr. No.	Course Objectives
1	To study the diversity of wild vegetables in the Wardha district.
2	To study the seed bank for wild vegetable genotypes from Wardha.
3	To study the implement diverse strategies for conserving the wild vegetable genotypes within the Wardha district.

Sr. No.	Course Outcomes
1	Students will be able to identifying various wild vegetables.
2	Students will be able to gain the skills necessary to maintain a seed bank containing wild vegetable genotypes.
3	Students will be able to acquire the ability to apply a range of conservation strategies to preserve wild vegetable genotypes

B.Sc. Sem II and IV
Generic Elective Course (GE)
Indian Farming System

Sr. No.	Course Objectives
1	To study the various agriculture system used by Indian farmers
2	To study the impact of agriculture on common population.
3	To study the advance technologies used in farming.

Sr. No.	Course Outcomes
1	Student will be able to explain integrated farming system.
2	Students will be able to describe strategies for improvement in farming.
3	Student will able to apply advance knowledge in traditional farming system.

Certificate Course in Green Career

Sr. No.	Course Objectives
1	To update the knowledge and provide a well-rounded green education.
2	To have utility for job and empowerment of the student.

Sr. No.	Course Outcomes
1	Students will be able to develop intention in pursuing a green career.
2	Students will be able to explain various sustainable practices use in waste management.
3.	Students will be able to explain advance technology used in waste management.

Certificate Course in Fundamentals of Molecular Biology

Sr. No.	Course Objectives
1	To study the principle of fundamental laboratory methodologies used in molecular biology.
2	To study the principles of basics of advance technique used in genetics engineering.

Sr. No.	Course Outcomes
1	Students will be able to discuss various techniques used in molecular biology.
2	Students will be able to apply their knowledge in advance experiments.

Shiksha Mandal's
Bajaj College of Science, Wardha (Autonomous) Syllabus
for B. Sc. I (SEM-I) w.e.f. 2023-24 PHYSICS DSC I:
MECHANICS
(Credits: Theory-04, Practicals-02) Theory: 60
Lectures

Course Description:

PHYSICS DSC 1: MECHANICS is designed for students of undergraduate course. This course will be of 60 hours theory and 60 hours practical. 4 credits are allotted to the theory course whereas 2 credits are allotted for practical.

Course Objective:

Basics of Astronomy course will facilitate undergraduate students:

- To know vectors and scalars and their fundamentals.
- To study Newtonian motions.
- To study conservation of momentum and energy.
- To study rotational motion
- To study gravitational Force.
- To study Simple harmonic motions.
- To study free, damped and forces Oscillations.
- To study elasticity and its applications.
- To calculate elastic modulus.
- To calculate g, spring constant and frequency

Course Learning Outcome:

Upon completion of course student will be able to:

- CO1: Identify vectors and scalars.
- CO2: Relate Newtonian motions with day-to-day physics.
- CO3: Understand conservation of momentum and energy in daily life.
- CO4: Define and employ rotational motion.
- CO5: Recognize Simple harmonic motions.
- CO6: Memorize elasticity and its applications.
- CO7: Perform accurate measurement using vernier calliper and screw gauge.
- CO8: Use various methods to calculate elastic modulus.
- CO9: Compute g, spring constant and frequency
- CO10: Solve problems related with viscosity and surface tension.

Syllabus for B. Sc. I (SEM-I) w.e.f. 2023-24 PHYSICS
MINOR I: MECHANICS
(Credits: Theory-04, Practicals-02) Theory: 60
Lectures

Course Description:

PHYSICS DSC 1: MECHANICS is designed for students of undergraduate course. This course will be of 60 hours theory and 60 hours practical. 4 credits are allotted to the theory course whereas 2 credits are allotted for practical.

Course Objective:

Basics of Astronomy course will facilitate undergraduate students:

- To know vectors and scalars and their fundamentals.
- To study Newtonian motions.
- To study conservation of momentum and energy.
- To study rotational motion
- To study gravitational Force.
- To study Simple harmonic motions.

- To study free, damped and forces Oscillations.
- To study elasticity and its applications.
- To calculate elastic modulus.
- To calculate g, spring constant and frequency

Course Learning Outcome:

Upon completion of course student will be able to:

- CO1: Identify vectors and scalars.
- CO2: Relate Newtonian motions with day-to-day physics.
- CO3: Understand conservation of momentum and energy in daily life.
- CO4: Define and employ rotational motion.
- CO5: Recognize Simple harmonic motions.
- CO6: Memorize elasticity and its applications.
- CO7: Perform accurate measurement using vernier calliper and screw gauge.
- CO8: Use various methods to calculate elastic modulus.
- CO9: Compute g, spring constant and frequency
- CO10: Solve problems related with viscosity and surface tension.

Syllabus for B. Sc. I (SEM-II) w.e.f. 2023-24 PHYSICS DSC-II: ELECTRICITY AND MAGNETISM
(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

Course Description:

This course can be taken by undergraduate students as a major course to understand the basic concepts of electricity and magnetism The course covers vector calculus, electrostatics, magnetostatics, electromagnetic induction and an introduction to Maxwell's equations (including wave solutions) as well as electric and magnetic fields in matter.

Learning Objectives:

This course aims to introduce students to the fundamental mathematical concepts related to vector calculus and their applications in the field of electrostatics. Through this course, students will gain an understanding of the concepts of magnetostatics and magnetic properties, as well as the principles of electromagnetic induction. Additionally, students will learn about the generation of electromagnetic waves and the principles of electrodynamics. By the end of this course, students will have a solid foundation in these key concepts and be well-equipped to apply them for solving problems.

Course Learning Outcomes (COs):

Upon completion students will be able to:

CO1: Understand the basic mathematical concepts related to electromagnetic vector fields.

CO2: Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.

CO3: Apply the principles of magnetostatics to the solutions of problems relating to Magnetic field density.

CO4: Understand the difference between magnetic materials from magnetic properties.
CO5: Understand the concepts related to Faraday‘s law and induction concepts for its applications in transformer to seek employment.
CO6: Apply Maxwell‘s equations to solutions of problems relating to wave propagation.

Syllabus for B. Sc. I (SEM-II) w.e.f. 2023-24 PHYSICS
MINOR 2: ELECTRICITY AND MAGNETISM
(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

Course Description:

This course can be taken by undergraduate students as a major course to understand the basic concepts of electricity and magnetism The course covers vector calculus, electrostatics, magnetostatics, electromagnetic induction and an introduction to Maxwell’s equations (including wave solutions) as well as electric and magnetic fields in matter.

Learning Objectives:

This course aims to introduce students to the fundamental mathematical concepts related to vector calculus and their applications in the field of electrostatics. Through this course, students will gain an understanding of the concepts of magnetostatics and magnetic properties, as well as the principles of electromagnetic induction. Additionally, students will learn about the generation of electromagnetic waves and the principles of electrodynamics. By the end of this course, students will have a solid foundation in these key concepts and be well-equipped to apply them for solving problems.

Course Learning Outcomes (COs):

Upon completion students will be able to:
CO1: Understand the basic mathematical concepts related to electromagnetic vector fields.
CO2: Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.
CO3: Apply the principles of magnetostatics to the solutions of problems relating to Magnetic field density.

CO4: Understand the difference between magnetic materials from magnetic properties.
CO5: Understand the concepts related to Faraday‘s law and induction concepts for its applications in transformer to seek employment.
CO6: Apply Maxwell‘s equations to solutions of problems relating to wave propagation.

B.Sc. Computer Science Semester - I

Course Outcomes-Fundamentals of Information Technology and Programming in ‘C’

Sr.No.	Course Outcomes	Knowledge levels (Bloom’s taxonomy)
CO1	Understand various number systems, generations of computer languages and translators.	L1- Remember, L2- Understand
CO2	Know various types of memories, storage devices, input and output devices.	L1- Remember, L2- Understand
CO3	Learn the concepts of networks, topologies, architecture, communication devices and recent technologies.	L1- Remember, L2- Understand
CO4	Learn to make basics programs and also able to draw algorithm and flowcharts of programs.	L1- Remember, L2- Understand
CO5	Perform programs using control and looping structure also understand the basic programs on arrays and functions.	L2- Understand, L3- Apply
CO6	Implementation of structures, pointers and file handling concepts in programming.	L2- Understand, L3- Apply

B.Sc. Computer Science Semester - II

Course Outcomes-Object Oriented using ‘C++’ and System Analysis and Design

Sr.No.	Course Outcomes	Knowledge levels (Bloom’s taxonomy)
CO1	Learn to write programs using Object Oriented Programming concepts like class and object.	L1- Remember, L2- Understand
CO2	Implementation of creation, deletion of objects and to make dynamic objects.	L2- Understand, L3- Apply

CO3	Understand the implementation of inheritance, virtual functions and exception handling using programming.	L2- Understand, L3- Apply
CO4	Understand components of Computerized Information Systems, role of Systems Administrator, various software development models; structured tools and techniques.	L1- Remember, L2- Understand
CO5	Know concepts associated with input and output design, form design, implementation activities and change strategies.	L1- Remember, L2- Understand
CO6	Get acquainted with the principles of testing strategies, conversion methods, planning and scheduling techniques, and advanced concepts.	L1- Remember, L2- Understand

B.Sc. Computer Science Semester - III

Course Outcomes-Data Structures and Operating System

Sr.No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Learn Stack and Queue data structures and implement it.	L1- Remember, L2- Understand, L3- Apply
CO2	Understand and Implementation of Linked List.	L1- Remember, L2- Understand, L3- Apply
CO3	Understand and implement sorting techniques, trees, and graphs.	L2- Understand, L3- Apply
CO4	Understand components of Operating Systems, roles, process management, and CPU scheduling.	L1- Remember, L2- Understand
CO5	Know concepts associated with deadlocks and memory management.	L1- Remember, L2- Understand
CO6	Get acquainted with the principles of IO management, file management, and protection mechanisms.	L1- Remember, L2- Understand

B.Sc. Computer Science Semester - IV

Course Outcomes-Data Structures and Operating System

Sr.No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Learn the basic concepts of Java programming like variables, data types, operators, class, and object.	L1- Remember, L2- Understand

CO2	Understand and Implementation of arrays, strings, inheritance, interface, packages and applets.	L2- Understand, L3- Apply
CO3	Understand and implement AWT and GUI components in Java.	L2- Understand, L3- Apply
CO4	Understand components of Linux Operating Systems, anatomy, shell, and basic Linux commands.	L1- Remember, L2- Understand
CO5	Know concepts associated backup and recovery mechanisms, and system administration.	L1- Remember, L2- Understand
CO6	Get acquainted with the techniques for disk management, communication utilities, and Linux GUIs.	L1- Remember, L2- Understand

B.Sc. Computer Science Semester - V

Course Outcomes-Visual Basic Programming and Database Management System

Sr.No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Learn the basic concepts of VB programming like components, variables, data types, operators, decision, and looping structures.	L1- Remember, L2- Understand
CO2	Understand and Implementation of arrays, procedure, function, and menus.	L2- Understand, L3- Apply
CO3	Understand and implement database handling mechanism, advanced controls like DAO, ADODC, and error handling.	L2- Understand, L3- Apply
CO4	Understand components of DBMS, architectures, DBMS users, and data models.	L1- Remember, L2- Understand
CO5	Learn concepts of extended E-R model and Relational model.	L1- Remember, L2- Understand
CO6	Get acquainted with the techniques for normalization.	L1- Remember, L2- Understand

B.Sc. Computer Science Semester - VI

Course Outcomes-Compiler Construction, SQL and PL/SQL

Sr.No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Learn the basic concepts of translators, types of translators, and phases of a compiler.	L1- Remember, L2- Understand

CO2	Understand essential elements HLL and role of lexical analyzer.	L1- Remember, L2- Understand
CO3	Identify various types of parsers, role of code optimization and code generation.	L1- Remember, L2- Understand
CO4	Understand and apply DML, DDL, DCL, and TCL statements in SQL.	L1- Remember, L2- Understand, L3- Apply
CO5	Learn and implement PL/SQL programming.	L1- Remember, L2- Understand, L3- Apply
CO6	Implement procedures, functions, and triggers.	L2- Understand, L3- Apply

B.Sc Semester I (Major & Minor)

History and Microbial Morphology (Major and Minor)

- **Course Objectives:**

1. Get an idea about the historical events in microbiology
2. Understand the diversity in microbiology
3. Know the scope of microbiology

- **Course Outcomes-**

After successful completion of the course, the student is expected to learn:

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	History of Microbiology and Contribution of various scientists in the development of Microbiology.	**L1- Knowledge/Remember, L2- Understand**
CO2	Scope of Microbiology in various fields like Food industry, Dairy industry, Pharmaceutical industry etc.	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Study on prokaryotic & eukaryotic microbes	**L1- Knowledge, L2- Understand**
CO4	Nutritional requirements of microorganisms	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Structure & classification of viruses & methods of cultivation of viruses	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Methods of cultivation of viruses	**L1- Knowledge, L2- Understand, L3- Apply**

SEMESTER I General Elective-I (GE-I)

Food spoilage and food safety

- **Course objectives**

1. To understand food microbiology with reference to food safety
2. To understand food spoilage, food poisoning and food borne diseases
3. To recognize the possible role of microorganisms to ensure public safety

- **Course outcomes:**

After successful completion of the course, the student is expected to learn:

1. Knowledge about food safety
2. Food Safety rules and regulations, Food safety Management System (FEMS)
3. Microbiological Risk assessment
4. Role of different microorganisms in food fermentation
5. Role of different microorganisms in food spoilage
6. Role of different microorganisms in food borne disease

SEMESTER I VSEC-I

Elementary Microbiology

- **Course objective**

1. To understand microbial morphology
2. To provide hand's on basic techniques in microbiology
3. To provide hand's on isolation of microbes for production of various secondary metabolites

- **Course Outcome**

After successful completion of the course, the student is expected to learn:

1. Practical skills of tools and techniques used to study microbiology.
2. Microbial technology and its applications in the production of industrially important microbial products.
3. Types of extracellular enzymes produced by bacteria and ferment variety or sugars.
4. Morphological characteristics of bacteria
5. Principles of carbohydrate fermentation by microbes
6. Techniques for mushroom cultivation

B.Sc Semester II (Major & Minor)

Microbial Techniques (major & minor)

- **Course Objectives:**

1. To understand the principles & applications of various microscopes
2. To understand principle and methodologies of various staining techniques
3. To understand the concept of microbial control and microbial interactions

- **Course Outcomes:**

After successful completion of the course, the student is expected to learn:

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Principles & applications of various microscopes.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Various staining techniques used in Microbiology	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Standard terminologies used in Microbial control.	**L1- Knowledge, L2- Understand**
CO4	Physical & chemical methods used for microbial control.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Different types of microbial interactions with plants, animals & with other microbes.	**L1- Knowledge, L2- Understand**
CO6	Significance of microbes in the ecosystem	**L1- Knowledge, L2- Understand**

SEMESTER II GE II

Basics of Soil Health

- **Course objectives:**

1. To impart in-depth information on soil and agriculture
2. To make the students understand the role of microbes in agriculture
3. Understanding the key concepts in soil and agricultural microbiology

- **Course outcomes:**

After successful completion of the course, the student is expected to learn:

1. Role of various microorganisms in biofertilizers production
2. Importance of biofertilizers
3. Physico-chemical aspects of the soil
4. Microbial diversity of soil
5. Role of microbes in the different biogeochemical cycles
6. Biological nitrogen fixation in symbiotic and non symbiotic associations with plan

SEMESTER II SEC II

Biopreservation of Perishable Foods

- **Course objectives:**

1. To learn food contamination and spoilage of perishable foods
2. To understand the antimicrobial action of lactic acid bacteria
3. To learn how to preserve perishable foods using Lactic acid bacteria

Course outcomes:

After successful completion of the course, the student is expected to learn:

1. Techniques for isolation of food borne bacteria
2. Identification of food borne bacteria on the basis of morphological, cultural and biochemical characteristics
3. Determination of total viable count in food sample
4. Demonstration of proteolytic organisms from perishable food samples
5. Antimicrobial activity of lactic acid bacteria by agar well diffusion method
6. Preservation of meat, fish & poultry by using Lactic acid bacteria

B.Sc Semester III (Major & Minor)

Chemistry of Organic Constituents, Enzymology and Metabolism (same for major & minor)

- **Course objectives:**

1. To understand major biomolecules carbohydrate, lipid, protein amino acids and nucleic acids.
2. To understand classification, structure & function of carbohydrate, lipid and proteins
3. To understand nature and scope of biochemistry

- **Course Outcomes**

After successful completion of the course, the student is expected to learn:

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	The biochemistry and metabolic pathway of carbohydrates will be understood.	**L1- Knowledge/Remember, L2- Understand**
CO2	Familiarise with amino acids and proteins chemistry and its metabolism.	**L1- Knowledge, L2- Understand**
CO3	biochemistry and metabolism of lipids and fats	**L1- Knowledge, L2- Understand**
CO4	Students can understand hereditary units of life, the replication process mechanism. Students get knowledge of nucleotide	**L1- Knowledge, L2- Understand**

	metabolism with purines and pyrimidines biosynthesis.	
CO5	Students will learn about the enzymes and enzyme kinetics	**L1- Knowledge, L2- Understand**
CO6	The concept of vitamins synthesis, structure and function.	**L1- Knowledge, L2- Understand**

SEMESTER III GE III

Introduction to Fresh Water Biology

- **Course objectives:**

1. To understand the fresh water ecosystem
2. To recognize the possible role of microorganisms in fresh water ecosystem
3. To understand the significance of water treatment

- **Course outcomes:**

After successful completion of the course, the student is expected to learn:

1. Knowledge about fresh water bodies, microbes involved in fresh water system.
2. Knowledge about potable water
3. water treatment using SSF and RSF
4. Significance of bacteriological analysis of water
5. Methods of chlorination, Water Quality Standards
6. Differences between fecal and non fecal organisms

SEMESTER III GE IV

Bioinnovation and Bioentrepreneurship

- **Course objectives:**

1. To understand Entrepreneurship with reference to microbiology
2. To recognize the possible role of microbiologist in Entrepreneurship
3. To understand the idea of start-up

- **Course Learning Outcomes:**

After successful completion of the course, the student is expected to learn:

1. The importance of Bio-Entrepreneurship
2. Different concepts required for practical execution as an Entrepreneur
3. Skills useful for becoming an entrepreneur
4. Concepts of biosafety and bioethics
5. Idea of IPR and patenting
6. Industrial production of Dairy products & fermented foods

SEMESTER III VSC III

Experimental Microbiology

- **Course objectives:**

1. To give learners the hands-on practice which enrich and develop practical skill in microbiology.
2. To study the bacterial flora of skin
3. To study the phylloplane microflora

- **Course Outcome**

After successful completion of the course, the student is expected to learn:

1. Good laboratory practices in microbiology laboratory.
2. Presence of microorganisms on plant, skin, and its role in developing a sustainable environment.
3. Importance of microorganisms in plant and human health
4. Importance of microorganisms in diseases
5. Effectiveness alcohol as skin antiseptic
6. Technique for determination of thermal death time and thermal death point of bacteria

SEMESTER III SEC IV
Microbiology of Wine Making

- **Course objectives:**

1. To enrich students' knowledge in wine technology & to build interdisciplinary approach
2. To inculcate sense of scientific aspects required in wine production
3. To help student's build-up a progressive and successful career as an entrepreneur

- **Course outcomes:**

After successful completion of the course, the student is expected to learn:

1. Detail about wine technology & different practices of wine making
2. Preparation of pure culture of wine yeast
3. Classification of wine.
4. Methods for isolation and purification of yeast
5. Methods for production of wine from fruits.
6. Avail the opportunities in the applied fields (research, industry or institutions).

B.Sc Semester IV (Major & Minor)
Industrial and Applied Microbiology (Same for major & minor)

- **Course objectives:**

1. Know about design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer.
2. Understand the rationale in medium formulation and design for microbial fermentation, sterilization of medium and air.
3. Understand the biochemistry of various fermentation.

Course outcomes:

After successful completion of the course, the student is expected to learn:

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	The general concepts of fermentation, types of bioreactor, strain development will be emphasized.	**L1- Knowledge/Remember, L2- Understand**
CO2	Scale up process, inoculum development, control and maintenance of physical factors and downstream processing will be understood.	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	The industrial production, biochemistry, recovery and uses of important fermentative products will be understood.	**L1- Knowledge, L2- Understand, L3- Apply**
CO4	Water microbiology and water treatment methods.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Microbiological analysis of air by various methods	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Biofertilizer & biopesticides	**L1- Knowledge, L2- Understand, L3- Apply**

SEMESTER IV GE-V
Introduction to Fermented Food Products

- **Course objectives:**

1. To understanding the role of microorganisms in food fermentation process
2. To understanding the key concepts in food and dairy microbiology

3. Give insight into commercialized fermented foods in the market

- **Course outcomes:**

After successful completion of the course, the student is expected to learn

1. Types of fermented foods and their significance.
2. Process of fermentation and role of microorganisms in it
3. The significance of probiotics
4. significance of prebiotics
5. Perception of microorganisms as food like SCP
6. Concept of functional foods

SEMESTER IV VSEC-V

Basic techniques in Industrial Microbiology

- **Course objective**

1. To get familiar with bioreactor
2. To understand various screening techniques for industrially important microbes
3. To study the extremophiles microbes

- **Course Outcomes**: Students will be able to:

1. Demonstrate practical skills in handling fermenter for cultivation of microorganisms and validation of autoclave
2. Demonstrate practical skills for validation of autoclave
3. Competent for isolation of potent microbial metabolite producers
4. Familiar with fermentative production of microbial metabolites
5. Gain knowledge about upstream processes in fermentation
6. Gain knowledge about downstream processes in fermentation

Shiksha Mandal's
Bajaj College of Science, Wardha
Department of Mathematics
2023-24
Program: B.Sc. **(Major In Mathematics), BSc(Minor in Mathematics)**

SEM-I (Major & Minor)
Course Objectives

1. To acquire the basic knowledge of number theory, matrices, complex numbers, partial differentiation and the basic topics of mathematics.
2. To apply the concepts of matrices, complex number, partial derivatives problems in science and engineering.
3. To develop the problem-solving skills by learning indeterminate forms, L'Hospital's rule, expansion of functions in power series.

Course Outcomes (COs)

Sr.No.	Course Outcomes
CO1	Student will have basic knowledge of number theory, matrices
CO2	Learners understand complex numbers and their properties
CO3	Student will have the ability to apply the concepts of matrices and complex numbers to problems in science and engineering.
CO4	Students will have skills to solve polynomial equations

CO5	Student will learn the mean value theorems, the basic concept of Maxima and Minima of functions of single variable and their applications.
CO6	Student will develop the problem-solving skills by learning indeterminate forms and L' Hospital's rule. Develop the skills expansion of functions in power series.
CO7	Student will have the ability to apply the knowledge of n^{th} derivative and partial derivative of the functions to solve the various problems
CO8	Students will be able to learn the partial derivatives of functions of two variables.

SEM-II (Major & Minor)

Course Objectives

1. To get the knowledge of beta-gamma function, integration, differential equations and vector calculus.
2. To apply the concept of gradient, divergence, curl , Green's, divergence, Stokes' theorems and differential equations in science and engineering.
3. To develop the problem-solving skills and apply Green's, divergence and Stokes' theorems to variety of problems.

Course Outcomes (COs)

Sr.No.	Course Outcomes
CO1	Students will be able to apply Beta and Gamma functions to evaluate the definite integrals.
CO2	Ability to solve double integration, triple integration problems, and apply it to find area, volume etc.
CO3	Student will get the understanding of various methods of solving differential equations of first and second order.
CO4	Able to apply the knowledge of solution of DE to various fields.
CO5	Student will gain the fundamental knowledge of vector differentiation
CO6	Students understand the concept of gradient, divergence, curl, solenoidal and irrotational vector fields
CO7	Students develop the ability to apply line integral to determine of work done by force.
CO8	Able to apply Green's, divergence and Stokes' theorems to variety of problems.

SEM-III

Course Objectives

1. To understand linear, non-linear partial differential equations of first order and higher order linear homogeneous, nonhomogeneous partial differential equations.
2. To apply differential equations to solve the real-world problems in science and technology.
3. To develop effective skill in presenting mathematical proofs, concepts, and ideas of algebra and ring theory.

Course Outcomes (COs)

Sr.No.	Course Outcomes
CO1	The learners understand linear, non-linear partial differential equations of first order and higher order linear homogeneous, nonhomogeneous partial differential equations
CO2	They enhanced problem-solving skills and the ability to think creatively in formulating and solution of differential equations.
CO3	Students can apply differential equations to solve the real-world problems in science and technology.
CO4	Student will able to learn extremize the functional and use of Eulers equation.
CO5	Student develops a deep understanding of algebraic structures, groups and subgroups.
CO6	Gain ability in abstract algebraic reasoning using algebraic methods, normal groups and permutation group.
CO7	Students will get the knowledge of ring theory.
CO8	Gain effective skill in presenting mathematical proofs, concepts, and ideas of algebra.

SEM-IV

Course Objectives

1. To acquire the knowledge of metric space and R-S integral.
2. To analyse the convergence of sequences and to apply the different tests for the convergence of the series.
3. To understand the power series solution of the differential equations
4. To develop the skills of representing any polynomials in Legendre's polynomial, and representation of function in terms of Fourier series.

Course Outcomes (COs)

Sr.No.	Course Outcomes
CO1	Students acquire a comprehensive understanding metric space.
CO2	Students become proficient to analyse the convergence of sequence.
CO3	Student able to apply the different tests for the convergence of the series.
CO4	Enhanced problem-solving skills and gain the knowledge to test the integrability of the function.
CO5	The learners understand power series solution of the differential equations.
CO6	They have enhanced the skills of representing any polynomials in Legendre's polynomial and application of special functions in various fields of science.
CO7	Students will able to apply Laplace transform to solve various differential equations
CO8	They will understand and learn for the representation of function in terms of Fourier series.

SEM-V

Course Objectives

1. To understand the concept of limits, continuity, and differentiability of complex functions and to develop the skills to construct the analytic function.
2. To get the knowledge of various types of transformations and to find the mapping in complex plane.
3. To analyse the various types of singularity of the functions.
4. To apply the method of complex integration to solve the real definite integral.
5. To acquire the knowledge of advanced topics such as Connectedness, Compactness, Lattices, Boolean algebra and Graph theory.

Course Outcomes (COs)

Sr.No.	Course Outcomes
CO1	Students gain understanding of limits, continuity and differentiability of complex functions. Acquire skills to construct analytic function.
CO2	They get the knowledge of various types of transformations and able to find the mapping in complex plane.
CO3	Students get understand to solve the complex integration.
CO4	They analyse the various types of singularity of the functions. Apply the method of complex integration to solve the real definite integral.
CO5	Students understand countability, metric spaces, closure, interior, open and closed sets.
CO6	Students acquire knowledge of advanced topics such as Connectedness, Compactness.
CO7	Learners get the knowledge of Lattices and Boolean algebra.
CO8	Students understand the Graph theory.

SEM VI

Course Objectives

1. To gain the knowledge of group theory, vector spaces and linear transformations etc.
2. To determine the Matrix associated with a linear map and linear map associated with a matrix.
3. To understand Newtonian Mechanics, Galilean and Lorentz transformation.
4. To understand the basic concepts of Einstein general theory of relativity.

Course Outcomes (COs)

Sr.No.	Course Outcomes
CO1	Students gain knowledge of group theory and vector spaces
CO2	They understand concepts of homomorphism, linear transformations etc
CO3	They able to determine the Matrix associated with a linear map and linear map associated with a matrix
CO4	Gain the knowledge of rank, nullity, Inner product spaces, Orthogonal and orthonormal vectors, Gram-Schmidt orthogonalization process
CO5	Learners understand Newtonian Mechanics, Galilean and Lorentz transformation
CO6	Students can derive Transformation for velocities and acceleration of a particle, length contraction and time dilation.
CO7	Students get realization of Space-Time structure and tensors
CO8	They understand Einstein's mass energy equation and Maxwell's equation of electromagnetic theory

Shiksha Mandal's

Bajaj College of Science, Wardha

Department of Languages

Session 2024-25

Subject : Ability Enhancement Course (AEC)/ Compulsory English

Course Objectives :

01. To enable students to get more acquainted with an international/foreign language like English.
02. To enable students to understand various sections like prose, poetry, grammar & composition.
03. To build a confidence in students for day to day English Speaking & Public speaking.
04. To develop all four skills of Literacy, i.e. listening, speaking, reading & writing.

Course Outcomes : After successful completion of the course,

CO1: Students will be able to review the grammatical forms of English and the use of these forms in specific communicative contexts, which include: class activities, homework assignments, reading of texts and writing.
CO2: Students will be able to attain and enhance competence in the four modes of literacy: writing, speaking, reading and listening.
CO3: Students will be able to practice using grammar in the form of tenses, voices, and prepositions.
CO4: Students will be able to write various types of letters, practice comprehensions, and use appropriate synonyms and antonyms whenever needed in sentence construction.

Shiksha Mandal's

Bajaj College of Science, Wardha (Autonomous)

Proposed Syllabus for Four Year Multidisciplinary UGProgram with DSC as Major
(e.g. Four Year B.Sc. Honours/Research Programme)

Programme: B.Sc. (Academic Session 2024-25)Syllabus

Ability Enhancement Course (AEC)

Semester I course inLanguages
Syllabus under Autonomy

ABILITY ENHANCEMENT COURSE (COMPULSORY ENGLISH)
Total Credits (02)
Theory (Credits: 02) (2 Lecture/week) 30 Hrs

Course description:

The course is designed for the students of science faculty who are admitted to B.Sc. Programme. This course is for sem I in particular. The course deals with the basic concepts in English Language, its grammar, sentence construction & syntax.

Course Objectives:

The aim of this course is to enable the students to understand the basic concepts in fourskills like listening, reading, speaking & writing so that they will be able to speak English fluently & flawlessly.

Course learning outcomes:

CO1: Students will develop an understanding about basic concepts in English.
CO2: Students will develop good skills in listening, speaking, reading & writing.
CO3: Students will be able to speak fluently, grammatically correct , without any hesitation.
CO4: Students will gain confidence in public speaking & day to day conversation.

Theory (02 Credits)

Unit-I Prose (10 Lectures)

1. The Birth of Khadi- Mahatma Gandhi
2. Go, Kiss the World !- Subroto Bagchi

Unit-II Poetry (10 Lectures)

1. Ulysses- Alfred Lord Tennyson
2. Yussouf-James Russell Lowell
3. If- Rudyard Kipling

Unit-III Comprehension & Grammar (10 Lectures)

1. Comprehension of Unseen Passage
2. Prepositions
3. Subject-verb agreement
4. Summarizing

Reference Books :

1. Empowering Minds by Raghav Publishers & Distributors
2. Macmillan Foundation English by R K Dwivedi & A Kumar
3. Oxford Practice Grammar by John Eastwood
4. English for Practical Purposes (Macmillan) by Z N Patil, B S Valke, Ashok Thorat, Zeenat Merchant
5. Learners' English Grammar & Composition (S. Chand) by N D V Prasada Rao

Mode of Evaluation :

A semester end examination (SEE) will be there for 35 marks and 15 marks will be therefor continuous internal evaluation (CIE). Duration of exam. will be three hours.

Ability Enhancement Course (AEC)

Semester II course in
Languages
Syllabus under Autonomy

ABILITY ENHANCEMENT COURSE (COMPULSORY ENGLISH)
TotalCredits(02)
Theory(Credits:02) (2 Lecture/week) 30Hrs

Course description:

The course is designed for the students of science faculty who are admitted to B.Sc. Programme.This course is for sem II in particular. The course deals with the basic concepts in English Language, its grammar,sentence construction,syntax & writing skills.

Course Objectives:

The aim of this course Is to enable the students to understand the basic concepts in four skills like listening, reading, speaking & writing so that they will be able tospeak English fluently & flawlessly.

Course learning outcomes:

CO1: Students will develop an understanding about basic concepts In English.
CO2: Students will develop good skills in listening,speaking,reading & writing.
CO3: Students will be able to speak fluently,grammatically correct,without any hesitation.
CO4: Students will gain confidence in public speaking & day to day conversation.

Indian Knowledge System (IKS)

Semester I course

INDIAN KNOWLWDGE SYSTEM (IKS)
Total Credits (02)
Theory (Credits: 02) (2 Lecture/week) 30 Hrs

Course description:

The course is designed for the students of science faculty who are admitted to B.Sc. Programme. This course is for sem I in particular. The course deals with the basic concepts in Indian knowledge system.

Course Objectives:

The aim of this course is to make them aware of Indian Knowledge System & enable the students to understand the basic concepts in IKS

Course learning outcomes:

CO1: Students will develop an understanding about basic concepts in IKS.
CO2: Students will develop good moral values
CO3: Students will develop respect for ancient culture and people.

Program: B.Sc. (Academic Session 2023-24) Syllabus under Autonomy DSC –I offered by Department of Zoology

Name of the course: **DSC –I Zoology- I (Non Chordate I and cell biology)**

[4hrs/week= 15*4 Th=60Th And 4 hrs/week= 15 weeks* 4 pract = 60 P]
[Credits 4 T+2 P = 6]

Course Description

This course is designed in such a way that the students will gain insights of Non-chordates animals till Phylum Annelida. The students will also learn about Cell Biology with respect to the structure, functions of the organelles as well as cell division.

Course Objectives

To learn the basics about Nonchordate animals upto Annelida and Cell Biology

Course Learning Outcomes

After successful completion of the course, the student is expected to

CO1: Students will be able to understand and have basic knowledge of Animal Kingdom, Animal Diversity, and its Classification with Major and Minor Phyla.

CO2:. The student should gain insights of the concept of Invertebrate animals starting from Protozoa (Single Cell Animalcules) to multicellular primitive animals like Porifera and Coelenterates to the higher Invertebrates up to Annelida.

CO3: Students will be able to understand the concept of Phylogenetic Tree of Evolution of Animals from primitive organic particles to higher Invertebrates.

CO4: Students will gain the basic knowledge of types of cells, cell structure, its organelles and functions.

CO5: Students will also get insights on origin, structure and function of primitive cell; its evolution and formation of advanced cell, reproduction of cell and abnormal cell division, uncontrolled cell division and cell culture technique.

CO6: Student passing out in semester I will acquire the knowledge of Non-chordates upto phylum Annelida as well as Cell Biology

Name of the course: DSC-II Zoology II
(Non Chordate II and Genetics)

[4hrs/week= 15*4 Th=60Th And 4 hrs/week= 15 weeks* 4 pract = 60 P]

[Credits 4 T+2 P = 6]

B.SC. Semester II

Paper II: Non Chordates-II and Genetics

Course Description

This course is designed in such a way that the students will gain insights of Non-chordates animals from Arthropoda to Hemichordata. Students will also learn about different types of parasites and vectors. The students will also gain insights on Genetics and its applications.

Course Objectives

To learn the basics about Nonchordates animals and Genetics

Course Learning Outcomes

After successful completion of the course, the student is expected to

CO1: Students will be able to understand and have basic knowledge of Animal Kingdom, Animal Diversity, and its Classification with from Arthropoda to Hemichordata.

CO2: The student should gain insights of the concept of parasitology and knowledge of vectors.

CO3: Students will be able to understand the concept of Genetics with respect to Mendelian and Non mendelian genetics

CO4: Students will gain the basic knowledge of Population genetics and Hardy Weinberg Law.

CO5: Students will also get insights on genetic disorders

CO6: Student passing out in semester II will acquire the knowledge of Non-chordates from Arthropoda to Hemichordata as well as Genetics

1. Programme Outcomes (POs) of M.Sc. (Botany)

The Master of Science (M.Sc.) in Botany at Bajaj College of Science (BCS) offers an advanced curriculum that enhances students' foundational knowledge in plant sciences. The program emphasizes specialized skills, research capabilities, and interdisciplinary perspectives, preparing graduates for careers in academia, research, and industry. The following are the Programme Outcomes (POs) for the M.Sc. Botany program:

PO1 – Advanced Disciplinary Expertise:
Graduates will demonstrate a comprehensive understanding of advanced botany concepts, including plant anatomy, physiology, taxonomy, ecology, and genetics. They will integrate theoretical and practical knowledge to address complex botanical challenges, contributing to advancements in plant sciences.

PO2 – Research and Innovation:
Graduates will be skilled in designing and conducting independent botanical research. They will formulate innovative research questions, employ modern methodologies in plant study, analyze ecological and physiological data, and interpret findings. Their research will contribute to the scientific community, addressing pressing issues such as plant conservation and sustainable agriculture.

PO3 – Critical and Analytical Thinking:
Graduates will apply critical thinking to evaluate scientific literature, research findings, and experimental data in botany. They will synthesize information from various sources, challenge assumptions about plant biology, and construct well-supported arguments that promote innovation and problem-solving in plant sciences.

PO4 – Communication and Presentation Skills:
Graduates will excel in written and oral communication, effectively conveying complex botanical concepts to both specialized and general audiences. They will proficiently present research findings, write scientific papers, and engage in academic discourse, ensuring clarity and precision in their communication.

PO5 – Interdisciplinary Collaboration:
Graduates will be adept at working across disciplines, collaborating with experts in areas such as microbiology, ecology, and environmental science. This interdisciplinary approach will enhance their research capabilities, integrating diverse perspectives to solve complex botanical problems.

PO6 – Technological Proficiency and Digital Literacy:
Graduates will be proficient in utilizing advanced technologies relevant to botany, including data analysis software, laboratory equipment, and digital research platforms. They will stay updated on technological advancements, applying them to improve research efficiency in plant science investigations.

2. Programme Outcomes (POs) of M.Sc. (Chemistry)

The Master of Science (M.Sc.) in Chemistry at Bajaj College of Science (BCS) provides an advanced curriculum that deepens students' understanding of chemical principles and practices. This program is designed to equip graduates with specialized skills, robust research capabilities, and interdisciplinary insights, preparing them for careers in academia, research, industry, or further studies. The following are the Programme Outcomes (POs) for the M.Sc. Chemistry program:

PO1 – Advanced Disciplinary Expertise:
Graduates will demonstrate a profound understanding of advanced concepts in chemistry, including organic, inorganic, physical, analytical, and biochemistry. They will integrate theoretical knowledge with practical applications to address complex chemical problems and contribute to advancements in the field.

PO2 – Research and Innovation:
Graduates will develop the ability to design and execute independent research projects in chemistry. They will formulate innovative research questions, employ modern methodologies for chemical synthesis and analysis, analyze experimental data, and interpret results. Their work will focus on creating new chemical compounds and addressing contemporary challenges in materials science and pharmaceuticals.
PO3 – Critical and Analytical Thinking:
Graduates will apply critical thinking and analytical reasoning to evaluate scientific literature, experimental designs, and chemical data. They will synthesize information from various sources, identify logical flaws, and construct well-supported arguments, fostering innovation and problem-solving in chemical research.
PO4 – Communication and Presentation Skills:
Graduates will excel in both written and oral communication, adeptly conveying complex chemical concepts to both specialist and non-specialist audiences. They will be proficient in presenting research findings, writing scientific papers, and participating in academic discussions, ensuring clarity and precision in their communication.
PO5 – Interdisciplinary Collaboration:
Graduates will be capable of working effectively across disciplines, collaborating with experts in related fields such as biology, environmental science, and material science. This interdisciplinary approach will enhance their research capabilities and contribute to solving complex chemical and environmental problems.
PO6 – Technological Proficiency and Digital Literacy:
Graduates will be proficient in utilizing advanced technologies relevant to chemistry, including data analysis software, spectroscopic and chromatographic techniques, and digital research platforms. They will stay updated on technological advancements, applying these tools to enhance research efficiency and effectiveness in chemical investigations.

3. Programme Outcomes (POs) of M.Sc. (Mathematics)

The Master of Science (M.Sc.) in Mathematics at Bajaj College of Science (BCS) offers an advanced curriculum designed to deepen students' understanding of mathematical concepts and techniques. This program prepares graduates for various careers in academia, research, industry, or further studies by equipping them with specialized skills, robust analytical abilities, and interdisciplinary insights. The following are the Programme Outcomes (POs) for the M.Sc. Mathematics program:
PO1 – Advanced Disciplinary Expertise:
Graduates will exhibit a comprehensive understanding of advanced mathematical theories and practices, including algebra, calculus, statistics, numerical methods, and topology. They will integrate theoretical knowledge with practical applications to solve complex mathematical problems and contribute to the advancement of mathematical sciences.
PO2 – Research and Innovation:
Graduates will develop the capability to design and conduct independent research projects in mathematics. They will formulate innovative research questions, employ appropriate methodologies, analyze data, and interpret results. Their work will focus on contributing new insights into mathematical theories and solving contemporary problems in areas such as applied mathematics and computational mathematics.
PO3 – Critical and Analytical Thinking:
Graduates will apply critical thinking and analytical reasoning to evaluate

mathematical literature, theories, and proofs. They will synthesize information from various sources, identify logical inconsistencies, and construct well-supported arguments, fostering innovation and problem-solving in mathematical research.

PO4 – Communication and Presentation Skills:

Graduates will excel in both written and oral communication, adeptly conveying complex mathematical ideas to both specialist and non-specialist audiences. They will be proficient in presenting research findings, writing mathematical papers, and engaging in academic discussions, ensuring clarity and precision in their communication.

PO5 – Interdisciplinary Collaboration:

Graduates will be capable of collaborating effectively across disciplines, working with experts in fields such as physics, engineering, economics, and computer science. This interdisciplinary approach will enhance their research capabilities and contribute to solving complex mathematical and scientific problems.

PO6 – Technological Proficiency and Digital Literacy:

Graduates will be proficient in utilizing advanced mathematical software and digital tools relevant to their field, such as MATLAB, R, and mathematical modeling software. They will stay current with technological advancements, applying these tools to enhance research efficiency and effectiveness in mathematical investigations.

4. Programme Outcomes (POs) for the M.Sc. (Microbiology):

The Master of Science (M.Sc.) in Microbiology at Bajaj College of Science (BCS) offers an advanced curriculum designed to enhance students' understanding of microbial sciences and their applications. This program prepares graduates for careers in academia, research, industry, and healthcare, equipping them with specialized skills, strong research capabilities, and interdisciplinary perspectives. The following are the Programme Outcomes (POs) for the M.Sc. Microbiology program:

PO1 – Advanced Disciplinary Expertise:

Graduates will demonstrate a comprehensive understanding of advanced microbiological concepts, including microbial physiology, genetics, ecology, and pathogenesis, integrating theoretical and practical knowledge to address complex microbiological challenges.

PO2 – Research and Innovation:

Graduates will be skilled in designing and conducting independent research in microbiology, employing modern techniques in molecular biology, microbiological analysis, and microbial culture, contributing to innovations in areas like disease control, biotechnology, and environmental microbiology.

PO3 – Critical and Analytical Thinking:

Graduates will apply critical thinking and analytical skills to evaluate scientific literature, research findings, and experimental data, enabling them to challenge existing paradigms and propose new approaches to microbiological problems.

PO4 – Communication and Presentation Skills:

Graduates will possess strong written and oral communication skills, effectively presenting complex microbiological research findings to both specialized and non-specialized audiences and preparing high-quality scientific reports and papers.

PO5 – Interdisciplinary Collaboration:

Graduates will be able to collaborate across disciplines with experts in related fields such as biochemistry, environmental science, and medical sciences, enhancing their ability to solve complex microbiological problems and contribute to interdisciplinary research.

PO6 – Technological Proficiency and Digital Literacy:
Graduates will be proficient in utilizing cutting-edge microbiological technologies, including laboratory instruments, data analysis software, and bioinformatics tools, to enhance research and diagnostic practices in microbiology.

5. Programme Outcomes (POs) of M.Sc. (Zoology)

The Master of Science (M.Sc.) in Zoology at Bajaj College of Science (BCS) offers an advanced curriculum that builds on students' foundational knowledge of animal biology. This program emphasizes specialized skills, research capabilities, and interdisciplinary perspectives, preparing graduates for careers in academia, research, and industry. The following are the Programme Outcomes (POs) for the M.Sc. Zoology program:

PO1 – Advanced Disciplinary Expertise:
Graduates will exhibit a comprehensive understanding of advanced zoological concepts, including animal physiology, ecology, taxonomy, ethology, and evolution. They will integrate theoretical and practical knowledge to tackle complex zoological issues, contributing to advancements in animal sciences and conservation.

PO2 – Research and Innovation:
Graduates will develop the skills necessary to design and conduct independent research in zoology. They will formulate innovative research questions, utilize modern methodologies for studying animal behaviour and physiology, analyse ecological and evolutionary data, and interpret results. Their contributions will address significant challenges in biodiversity conservation and wildlife management.

PO3 – Critical and Analytical Thinking:
Graduates will apply critical thinking and analytical reasoning to evaluate scientific literature, research findings, and experimental data related to animal biology. They will synthesize information from diverse sources, challenge assumptions about animal interactions and adaptations, and construct well-supported arguments that foster innovation and problem-solving in zoological studies.

PO4 – Communication and Presentation Skills:
Graduates will excel in both written and oral communication, effectively conveying complex zoological concepts to specialized and non-specialized audiences. They will proficiently present research findings, write scientific papers, and engage in academic discussions, ensuring clarity and precision in their communication.

PO5 – Interdisciplinary Collaboration:
Graduates will possess the ability to collaborate across disciplines, working with experts in related fields such as ecology, microbiology, and conservation biology. This interdisciplinary approach will enhance their research capabilities, integrating diverse perspectives to solve complex zoological problems.

PO6 – Technological Proficiency and Digital Literacy:
Graduates will be proficient in utilizing advanced technologies relevant to zoology, including data analysis software, laboratory equipment, and digital research platforms. They will stay updated on technological advancements, applying them to enhance research efficiency and effectiveness in animal studies.

Programme Specific Outcomes (PSOs) for the M.Sc. Botany program:

PSO1 – Plant Research Expertise:
Graduates will develop specialized knowledge in areas such as plant taxonomy, ecology, and genetics, enabling them to conduct focused research in specific domains of botany.

PSO2 – Advanced Laboratory Skills:
Graduates will gain hands-on proficiency in modern laboratory techniques for plant analysis, including microscopy, molecular biology, and plant tissue culture.

PSO3 – Environmental and Agricultural Solutions:
Graduates will be equipped to apply their botanical knowledge to solve environmental and agricultural challenges, particularly in the areas of plant conservation, sustainable agriculture, and ecological restoration.

Programme Specific Outcomes (PSOs) for the M.Sc. Chemistry program:

PSO1 – Specialized Chemical Knowledge:
Graduates will gain in-depth expertise in specialized fields such as organic, inorganic, and analytical chemistry, enabling them to tackle complex chemical problems.

PSO2 – Research Methodology Proficiency:
Graduates will develop strong research skills, including experimental design, chemical synthesis, and data analysis, contributing to innovative solutions in chemistry.

PSO3 – Application of Chemistry in Real-World Problems:
Graduates will apply their chemical knowledge to address real-world challenges in areas such as materials science, pharmaceuticals, and environmental chemistry.

Programme Specific Outcomes (PSOs) for the M.Sc. Mathematics program:

PSO1 – Advanced Mathematical Techniques:
Graduates will acquire in-depth knowledge of advanced mathematical techniques, including algebra, calculus, and topology, to solve complex mathematical problems.

PSO2 – Independent Research and Problem Solving:
Graduates will develop the ability to independently design and conduct research, contributing innovative solutions to mathematical challenges in applied and computational mathematics.

PSO3 – Application of Mathematics in Interdisciplinary Fields:
Graduates will apply their mathematical expertise to solve problems in interdisciplinary fields such as physics, engineering, and economics, demonstrating the versatility of mathematics in various contexts.

Programme Specific Outcomes (PSOs) for the M.Sc. Zoology program:

PSO1 – Specialized Zoological Knowledge:
Graduates will gain specialized knowledge in areas such as animal physiology, ecology, and evolution, equipping them to address complex zoological challenges.

PSO2 – Independent Research and Analysis:
Graduates will develop strong research capabilities, including the design and execution of independent studies in animal behavior, conservation, and biodiversity.

PSO3 – Application of Zoology in Interdisciplinary Research:
Graduates will apply their understanding of zoology to collaborate with experts in related fields, such as ecology and conservation biology, to address global wildlife and biodiversity issues.

Programme Specific Outcomes (PSOs) for the M.Sc. Microbiology program:

PSO1- **Specialized Microbiological Knowledge:**
: Graduates will demonstrate proficiency in microbiological techniques and methodologies, applying them to solve real-world problems in clinical, industrial, and environmental microbiology.
PSO2-**– Independent Research and Analysis:**
Graduates will conduct independent research, contributing to advancements in microbial biotechnology, disease management, and environmental sustainability.
PSO3**– Application of Microbiology in Interdisciplinary Research:**
Graduates will effectively communicate complex microbiological concepts and research findings to a diverse audience through written and oral presentations.

Course outcomes of MSc Botany

Course Name Phycology, Mycology and Bryophytes
Course Credit 04 + 02 (06)
Course working Hours 60 Hrs (L)
Course Structure Theory and Practicals

Course Description: The course includes diversity distinct characters life cycles, economic and ecological importance of algae, fungi and bryophytes.
Course Objectives: The purpose of this syllabus is to understanding knowledge about identifying lower cryptogams and Microbes. To develop skill in identifying microbial cultures and their preservation. To familiarize the students about distinctive diversity of algae, fungi and bryophytes.
Course learning outcomes: This course will enable students to know the lower plants, their vegetative structures and their importance. From this course student will

gain the knowledge of classification by using certain key characters. They will also understand morphological, anatomical, and reproductive structure of lower group of plants such as algae, fungi and bryophytes. Students will develop basic skill in handling, sectioning and culturing of algae and fungi. Gain practical knowledge of preparing various microbial cultures and identifying them

Master of Science (Botany) Semester I
Course Code DSC-II
Course Name Pteridophytes, Paleobotany and Gymnosperms
Course Credit 04 + 02 (06)
Course working Hours 60 Hrs (L)
Course Structure Theory and Practicals

Course Description: To acquaint the students about different pteridophytic, gymnospermic flora.

Course Objectives: This course aims to prepare understanding of evolutionary diversification of early land plants also their histories. The course aims to distinguish morphological, anatomical and reproductive variations in pteridophytic, gymnospermic plants

Course learning outcomes: Students will compare and describe General Characters, classification system, distribution of pteridophytes, gymnosperms and fossil history of both.

M.Sc. MICROBIOLOGY SEMESTER -I

Course Objective Sem I I DSC – 1 (Microbial metabolism) PMB511T

1) To understand about bioenergetics and microbial metabolism
2) To Gain an understanding of photosynthesis, anoxygenic photosynthesis and chemolithotrophy
3) To be able to study in detail knowledge about mechanism and types of Nitrogen and Sulphur metabolism and methanogenesis

Master of Science (Botany) Semester I
Course Code DSE-I
Course Name Tools and Techniques
Course Credit 04 + 02 (06)
Course working Hours 60 Hrs (L)
Course Structure Theory and Practicals

Course Description:

This course offers a comprehensive exploration of essential tools and techniques used in the field of botany. Through a balanced combination of theoretical understanding and hands-on practical experience, students will gain proficiency in various laboratory methodologies and analytical approaches commonly employed in plant research. The course is designed to equip students with the foundational knowledge and skills necessary to conduct experiments, analyze plant specimens, and interpret experimental results.

Course Objectives:

1.Gain a comprehensive understanding of the SI system of measurement, fundamental and derived units, and apply this knowledge to make accurate solutions with specific concentrations.
2.Understand the principles of microscopy, including light microscopy, fluorescence microscopy, and confocal microscopy.

3.Develop competency in techniques such as centrifugation, both differential and density gradient, for cell fractionation.
4.Acquire skills in working with radioisotopes, including the calculation of half-life and specific activity, and learn to measure radioactivity using various radiation counters and scintillation counters.
5.Understand principles of chromatography and Gain hands-on experience in a range of chromatography techniques, including paper chromatography, column chromatography, TLC, GLC, and HPLC.
Course learning outcomes: The course will enable to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization in biology.

Master of Science (Botany) Semester I
Course Code RM
Course Name Research Methodology
Course Credit 04 + 02 (06)
Course working Hours 60 Hrs (L)
Course Structure Theory and Practicals

Course Objectives:
1.Gain a comprehensive understanding of research methodology and its fundamental concepts.
2.Develop the ability to critically evaluate and select appropriate research methods for different types of research.
3.Acquire skills in data collection, analysis, and interpretation using various statistical techniques.
4.Enhance proficiency in technical writing, research reporting, and adherence to research ethics and academic integrity.
Course Outcomes:
After learning research methodology course, students will be able to
1.Identify and describe the characteristics of different types of research, including basic, applied, and patent-oriented research.
2.Apply scientific thinking and problem identification techniques in the research process.
3.Apply descriptive and inferential statistical analysis techniques to analyze and interpret research data and understand the concept of hypothesis and its importance in research, and apply appropriate research methods.
4.Develop skills in technical writing, research reporting, and the proper structure and organization of research documents and gain awareness of research ethics, academic integrity, and the importance of avoiding plagiarism and academic malpractice.

Master of Science (Botany) Semester II Course Code DSC-V
Course Name Genetics and Plant breeding
Course Credit 04
Course working Hours 60 Hrs (L)
Course Structure Theory

Course objectives: This course aims to recognize principles of Mendelian and non-Mendelian inheritance, quantitative genetics, epigenetics, cytogenetic and crop genetics resources.
Course Learning Outcomes:

CO1: Students will be able to explain Mendel's laws of inheritance, multiple alleles and isoalleles, gene interactions, suppressors, and pleiotropic genes; multigene families; extrachromosomal inheritance, chromatin organization.
CO2: Students will construct Karyotype analysis and evolution, banding patterns, chromosomal aberrations, and their use in chromosome mapping; population genetics.
CO3: Students will illustrate molecular basis of gene mutations; transposable genetic elements; plant genetic resources, epigenetics.
CO4: Understand objectives of plant breeding, compare various selection methods to improve cultivars with desirable and understand hybridization process.

Master of Science (Botany) Semester II
Course Code DSC-VI
Course Name Cell Biology and Molecular Biology- I
Course Credit 04
Course Working Hours 60 Hrs (L)
Course Structure Theory and Practicals

Course objectives: This course aims to prepare basics of cell structure in relation to functions and provide cellular and molecular events in response to various stresses.

Course Learning Outcomes:

CO1: Students will be able to explain cell membrane features, transport mechanisms and structure and function of plasmodesmata.
CO2: Students will elucidate cytoskeleton, microtubules, microfilaments and intermediate filaments and their role in cell division.
CO3: Students will describe ultrastructure of nucleus, forms of DNA and DNA replication. CO4: Students will compare stages of transcription in both prokaryotes and eukaryotes CO5: Students will compare salient features of organelle genomes.

Master of Science (Botany) Semester II Course Code DSE-II
Course Name Angiosperm Morphology and Economic Botany
Course Credit 04 + 02 (06)
Course working Hours 60 Hrs (L)
Course Structure Theory and practicals

Course objectives: This course aims to introduce principles of angiosperm morphology, species concept, evolutionary inferences of important morphological characters and biodiversity assessments.

Course Learning Outcomes:

CO1: Students will be able to explain angiosperm morphology, floral organs, and their evolutionary significance.
CO2: Students will construct hierarchy in taxonomy, understand species and taxon concept with help of qualitative and quantitative characters.
CO3: Students will evaluate herbaria, monographs, biochemical and molecular tools for plant identification and diversity assessment.
CO4: Students will be able to describe the origins, morphology, and uses of these important cereal crops, legumes, spices, beverage crops, and fibre yielding plants.

Master of Science (Botany) Semester II Course Code FP/OJT/RP
Course Name Field Project in Botany/Research project
Course Credit 08
Course working Hours 60 Hrs
Course Structure Field work or research based

Course Description:
The Fieldwork in Botany course provides MSc Botany students with a unique opportunity to immerse themselves in real-world research and data collection experiences. Over a period of eight to ten weeks, students will have the chance to conduct fieldwork in various settings, locally to address specific research questions related to the field of botany. The course structure is primarily hands-on, encompassing fieldwork, on-the-job training, or research- based activities. This course is designed to complement the theoretical knowledge acquired during previous courses and enable students to gather primary and/or secondary data that cannot be accessed through desk research alone.

Course Learning Objectives:
To develop practical skills in botany, allowing them to apply theoretical knowledge to real- world situations, such as conducting fieldwork, on-the-job training, or research projects.
To design and implement a fieldwork project relevant to botany.
To gain hands-on experience in data collection techniques specific to botany. To analyze and interpret field-collected data to address research questions.

Course Learning Outcomes:
Upon successful completion of the Fieldwork in Botany course, students will be able to:
CO1: Design a research project with a clear research question related to botany.
CO2: Demonstrate proficiency in various data collection methods, including plant observation, specimen collection, and environmental data recording.
CO3: Conduct semi-structured interviews and surveys to gather relevant information for botanical research.
CO4: Analyze and interpret field data to draw meaningful conclusions and prepare comprehensive fieldwork reports and presentations.
CO5: Apply their theoretical knowledge of botany to practical settings, demonstrating proficiency in fieldwork, research, or on-the-job tasks.

Master of Science (Botany) Semester III - DSC – 09
Course Code PBO631T
Course Name Angiosperm Taxonomy
Course Credit 04
Course Working hours 60 hrs.
Course Structure Theory and Practicals

Course objectives: This course aims to prepare the students to the advanced concepts and principles of taxonomy, phylogeny and evolution of angiosperm, important families of flowering plants, their classification and their current status as per angiosperm phylogeny.

Course Learning Outcomes:
CO1: Students will be able to understand salient features of various plant families, evolutionary inference of various morphological characters.
CO2: Students will describe outline of recent classification system and their significance and limitations.
CO3: Students will understand biodiversity assessment and importance of local plant diversity.

Master of Science (Botany) Semester III - DSC – 10
Course Code PBO632T
Course Name Plant Ecology
Course Credit 04

Course Working hours 60 hrs
Course Structure Theory and Practicals

Course objectives: The main objective of the course is to introduce the students to the concepts and principles of community ecology, conservation and applications of these concepts to solve ecological challenges.

Course Learning Outcomes:

CO1: Students will be able to describe and compose concept of community, ecological niche and interspecific interactions of plant as individuals and as community.

CO2: Students will perceive mechanisms of factors controlling primary production and litter fall decomposition. Students will prepare and assess ecological impact assessment and ecology of plant invasion.

CO3: Students will explain importance of botanical garden, seed banks in conservation of plants and understand structures of sanctuaries, biosphere reserves and other types of protected areas.

CO4: Students will be able to know the current status of biodiversity and its conservation

CO5: Students will aware regarding different agencies working in ecology conservation

Master of Science (Botany) Semester III - DSC -11
Course Code PBO633T
Course Name Plant Development and Reproduction
Course Credit 4
Course Working Hours 60 hrs
Course structure Theory and Practical

Course objectives: This course aims to prepare the students acquainted with a fundamental understanding of mechanisms associated with plant growth and development and differentiation of various plant organs. The course aims to distinguish anatomical and reproductive changes in flowering plants.

Course Learning Outcomes:

CO1: Students will be able to describe seedling growth and shoot development. Students will understand the differences between leaf and root development.

CO2: Students will compare and describe male and female gametophyte developments. Students will explain the molecular mechanism of flower development.

CO3: Students will compare embryo development and illustrate embryogenesis, pistil, seed development and interpret changes associated with senescence.

CO4: Students will able to describe seed development and interpret changes associated with senescence.

Master of Science (Botany) Semester III - DSE -03
Course Code PBO635T
Course Name Mycology and Plant Pathology-I
Course Credit 2
Course Working Hours 30 hrs
Course structure Theory and Practical

Course objectives: This course will provide and understanding of students in relation to basic concepts of Mycology and Mycotechniques., This course will aim to distinguish the role of fungi in dermatophytes and medical mycology.

Course Learning Outcomes:

CO1:Students will be able to describe different variety of fungal diversity in a different ecosystem as well as mycorrhizal diversity and Myco-techniques used in the field of Mycology.
CO2:This course consist of basic introduction to medical mycology and Students will be able to understand different types of dermatophytic fungi and gain the knowledge related to biodegradable fungi.
CO3:Students will describe and understand industrial and non-industrial fungal metabolites.
CO4:Students will be able to describe the role of fungi in food and understand the concept of pathogen control at biochemical and molecular level. Upon completion of this course student shall acquire the practical skill for the cultivation of fungi.

Master of Science (Botany) Semester III - DSE -03
Course Code PBO635T
Course Name Molecular Biology and Plant Biotechnology-I
Course Credit 2
Course Working Hours 30 hrs
Course structure Theory and Practical

Course objectives: This course aims to prepare students with an understanding of principles andtechniques of plant tissue culture, recombinant DNA technology concepts and applications and basics of bioinformatics.

Course Learning Outcomes:
CO1: Students will be able to explain principles and techniques of plant tissue culture.
CO2: Students will elucidate principles, tools and techniques of gene cloning process.
CO3: Students will describe and compare various cloning vectors and understand their role in cloning process.
CO4: Students will understand basics of bioinformatics

Master of Science (Botany) Semester III - RP
Course Code PBO638P
Course Name Research Project in Botany
Course Credit 4
Course Working Hours 120 hrs
Course structure Practical
Course Structure Project based or research based

Course Description:
The research project in Botany course provides MSc Botany students with a unique opportunity to immerse themselves in real-world research and data collection experiences. Over a period of eight to ten weeks, students will have the chance to conduct research project in various settings, locally to address specific research questions related to the field of botany. This course is designed to complement the theoretical knowledge acquired during present and past courses and enable students to gather primary and/or secondary data that cannot be accessed through desk research alone.

Course Learning Objectives:
CO1: To develop practical research skills in the field of botany.
CO2: To design and implement a research project relevant to botany.
CO4: To gain hands-on experience in data collection techniques specific to botany.

CO4: To analyze and interpret field-collected data to address research questions.
Course Learning Outcomes:
Upon successful completion of the research project in Botany course, students will be able to:
CO1: Design a research project with a clear research question related to botany.
CO2: Demonstrate proficiency in various data collection methods, including plant observation, specimen collection, and environmental data recording.
CO3: Conduct semi-structured interviews and surveys to gather relevant information for botanical research.
CO4: Analyze and interpret field data to draw meaningful conclusions and prepare comprehensive research project reports and presentations.
CO5: Collaborate effectively in research project teams and adapt to diverse cultural and environmental contexts during research project.

Master of Science (Botany) Semester IV - DSC – 13
Course Code PG-BOT (06) – S4- T13
Course Name Advanced Plant Physiology and Biochemistry
Course Credit 04
Course Working hours 60 hrs.
Course Structure Theory and Practicals

Course objectives: This course aims to provide an in-depth understanding of plant physiology, focusing on membrane transport, sensory photobiology, organelle functions, plant defense mechanisms, and the biochemical pathways of primary and secondary metabolites.

Course Learning Outcomes:
CO1: Students will be able to analyze the structure and function of plant membranes, including channels, pumps, carriers, and the role of photoreceptors in light-induced responses.
CO2: Students will describe the physiological roles of organelles such as plastids and mitochondria in the biosynthesis and transport of key molecules.
CO3: Students will understand the molecular mechanisms underlying plant defense systems, including phytoalexin production and the role of R-genes in plant-pathogen interactions.
CO4: Students will examine the biosynthesis and application of primary and secondary metabolites, and assess plant responses to various biotic and abiotic stresses.

Master of Science (Botany) Semester IV - DSC – 14
Course Code PG-BOT (06) – S4- T14
Course Name Plant Biotechnology and Bioinformatics
Course Credit 04
Course Working hours 60 hrs
Course Structure Theory and Practicals

Course objectives: This course aims to equip students with a comprehensive understanding of recombinant DNA technology, genetic engineering, plant tissue culture, and bioinformatics, with practical insights into their applications in research and biotechnology.

Course Learning Outcomes:
CO1: Students will be able to understand basics of gene cloning techniques, vector selection, and the construction and screening of DNA libraries.

CO2: Students will Apply genetic engineering principles to the development of transgenic plants and microbial genetic manipulation, including DNA sequencing and fingerprinting.
CO3: Students will Understand the principles and applications of plant tissue culture, including somatic embryogenesis, protoplast culture, and transgenic crop production.
CO4: Students will Utilize bioinformatics tools for sequence analysis, database management, and phylogenetic studies, integrating computational approaches into biological research.

Master of Science (Botany) Semester IV - DSC -15
Course Code PG-BOT (06) – S4- T15
Course Name Plant Resources
Course Credit 4
Course Working Hours 60 hrs
Course structure Theory

Course objectives: This course aims to provide students with a broad understanding of the economic importance of plants, focusing on their role in food, medicine, and industry, as well as the phytochemical properties of plant-based drugs.

Course Learning Outcomes:

CO1: Students will be able to understand the historical and economic significance of various food plants, fiber-yielding plants, and other economically important plant resources.
CO2: Students will Identify and classify crude drugs based on plant anatomy and evaluate them using organoleptic, microscopic, and chemical methods.
CO3: Students will Analyze the phytochemistry of plant-based drugs, including secondary metabolites like glycosides, alkaloids, and phenolics, and their medicinal properties.
CO4: Students will Explore the industrial applications of plants, including their use in the paper and pulp industry, production of beverages, extraction of dyes, essential oils, and the cultivation and processing of rubber.

Master of Science (Botany) Semester IV - DSE -16
Course Code PG-BOT (06) – S4- T16
Course Name Mycology and Plant Pathology-I
Course Credit 2
Course Working Hours 30 hrs
Course structure Theory

Course objectives: This course aims to provide students with a foundational understanding of mycology, plant pathology, and plant disease management, with a focus on the identification, control, and impact of various plant diseases in economically important crops.

Course Learning Outcomes:

CO1:Students will be able to understand the history of mycology, principles of plant pathology, and the defense mechanisms plants use against pathogens, including both morphological and biochemical strategies.
CO2:Students will be able to apply principles and methods of plant disease control, including cultural, chemical, biological, and transgenic approaches, and evaluate the effectiveness of biopesticides.
CO3:Students will describe the role of biological control and integrated pest management (IPM).

CO4:Students will be able to identify and assess the symptoms, causes, and control measures of diseases in various crops.

Master of Science (Botany) Semester IV - DSE -16
Course Code PG-BOT (06) – S4- T16
Course Name Molecular Biology and Plant Biotechnology-II
Course Credit 2
Course Working Hours 30 hrs
Course structure Theory

Course objectives: This course aims to impart comprehensive knowledge of plant tissue culture techniques, DNA fingerprinting, gene expression analysis, and the application of genetic transformation in developing transgenic plants for agricultural and industrial purposes.

Course Learning Outcomes:

CO1: Students will be able to explain the various methods of gene transfer in plants, including Agrobacterium-mediated and direct DNA transfer techniques.
CO2: Students will Apply DNA fingerprinting techniques and PCR-based markers in marker-assisted breeding and genetic analysis.
CO3: Students will Analyze gene expression at the transcriptional level using techniques like Northern hybridization, differential display, and DNA microarrays.
CO4: Students will evaluate the applications of genetic transformation in creating transgenic plants with enhanced traits such as herbicide and insect resistance, and explore the implications

Master of Science (Botany) Semester IV - RP
Course Code PBO648P
Course Name Research Project in Botany
Course Credit 6
Course Working Hours 120 hrs
Course structure Practical
Course Structure Project based or research based

Course Description:

The research project in Botany course provides MSc Botany students with a unique opportunity to immerse themselves in real-world research and data collection experiences. Over a period of eight to ten weeks, students will have the chance to conduct research project in various settings, locally to address specific research questions related to the field of botany. This course is designed to complement the theoretical knowledge acquired during present and past courses and enable students to gather primary and/or secondary data that cannot be accessed through desk research alone.

Course Learning Objectives:

CO1: To develop practical research skills in the field of botany.
CO2: To design and implement a research project relevant to botany.
CO4: To gain hands-on experience in data collection techniques specific to botany.
CO4: To analyze and interpret field-collected data to address research questions.

Course Learning Outcomes:

Upon successful completion of the research project in Botany course, students will be able to:
CO1: Design a research project with a clear research question related to botany.
CO2: Demonstrate proficiency in various data collection methods, including plant observation, specimen collection, and environmental data recording.

CO3: Conduct semi-structured interviews and surveys to gather relevant information for botanical research.
CO4: Analyze and interpret field data to draw meaningful conclusions and prepare comprehensive research project reports and presentations.
CO5: Collaborate effectively in research project teams and adapt to diverse cultural and environmental contexts during research project.

Course outcomes of MSc Microbiology

Course Outcomes- Sem I DSC – 1 (Microbial metabolism) PMB511T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to correlate specific aspects of Bioenergetics and Metabolism	**L1- Knowledge/Remember, L2- Understand**
CO2	Students will be able to identify and differentiate between major classes of biological molecules like protein and Nucleic acids with its chemistry and metabolism	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will be able to Gain an understanding of photosynthesis, anoxygenic photosynthesis and chemolithotrophy.	**L1- Knowledge, L2- Understand**
CO4	Students will be aware of the mechanism and types of Nitrogen and Sulphur metabolism and methanogenesis	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will understand and learn about metabolism	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	The course describes the Microbial metabolism in detail	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective- Sem I DSC – 2 (Enzymology and Techniques) PMB512T

1) To understand about enzyme characteristics and kinetics
2) Apply knowledge of various technique such as protein isolation, purification and various application of enzyme in industry.
3) Understand the various biochemical techniques based on enzymes like biosensors

Course Outcomes- Sem I-Paper II DSC – 2 (Enzymology and Techniques) PMB512T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to understand general characteristics of enzymes (Terminologies)	**L1- Knowledge/Remember, L2- Understand**
CO2	Students will learn the different mechanisms of enzyme catalysis	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will be able to Gain an understanding of enzyme kinetics and regulation	**L1- Knowledge, L2- Understand**
CO4	Students will be able to understanding the various biochemical techniques based on enzymes like biosensors	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	The course describes isolation and purification enzyme in detail	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Overall, the course describes the Enzymology and Techniques in detail	**L1- Knowledge, L2- Understand, L3- Apply**

Course outcomes Sem I DSE – 1 (Advanced Techniques in Microbiology) PMB515T

1) To understand in detail about working and principle of various advanced instruments in microbiology
2) To apply and understand the working various instruments like electrophoresis, centrifugation, microscopy and chromatography
3) Apply the knowledge of instrumentation in life sciences, which is needed in industry as well as research laboratories.

Course outcomes Sem I DSE – 1 (Advanced Techniques in Microbiology) PMB515T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to understand the important aspects of advance	**L1- Knowledge/Remember, L2- Understand, L3- Apply**

	biophysical techniques used in microbiology	
CO2	Students will learn the working and principles of various instruments like electro[horess, centrifugation and chromatography	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will gain knowledge of important microscopy techniques from basic to advanced one	**L1- Knowledge, L2- Understand, L3- Apply**
CO4	Students will be able to understand the applications of advanced technique in different aspects of life sciences.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	This course overall gives the understanding of instrumentation in life sciences, which is needed in industry as well as research laboratories.	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Apply this techniques in research project during academic session	**L1- Knowledge, L2- Understand, L3- Apply**

Course objective Sem I Sem I DSE – 1 (Membrane Structure and Signal Transduction) PMB515T

1. Understand in depth knowledge of membrane structure and signal transduction
2. Explain principle of structure and function of membranes and organelles
3. Apply knowledge in research based on cell biology and signal transduction on research projects

Course outcome Sem I - DSE – 1 (Membrane Structure and Signal Transduction) PMB515T

Sr. No.	**Course Outcomes**	**Knowledge levels (Bloom's taxonomy)**
CO1	Students will be able to understand the important aspects of cell biology like membranes and organelles	**L1- Knowledge/Remember, L2- Understand**
CO2	Students will learn the structure and function of membranes and organelles	**L1- Knowledge, L2- Understand**
CO3	Students will understand the important things about cellular transport and their energetics	**L1- Knowledge, L2- Understand**

CO4	Students will learn about the detailed concept of signal transduction	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	This knowledge will increase students' interest in research based on cell biology and signal transduction and they can be hired on such research projects	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	This knowledge of signal transduction help them for study in competitive examination.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objectives of Research methodology (RM) PMB516T

1. Gain a comprehensive understanding of research methodology and its fundamental concepts.
2. Develop the ability to critically evaluate and select appropriate research methods for different types of research.
3. Acquire skills in data collection, analysis, and interpretation using various statistical techniques.
4. Enhance proficiency in technical writing, research reporting, and adherence to research ethics and academic integrity.

Course Outcomes of Research methodology (RM) PMB516T

Sr. No.	**Course Outcomes**	**Knowledge levels (Bloom's taxonomy)**
CO1	Students will identify and describe the characteristics of different types of research, including basic, applied, and patent-oriented research	**L1- Knowledge/Remember, L2- Understand**
CO2	Students will apply scientific thinking and problem identification techniques in the research process	**L1- Knowledge, L2- Understand**
CO3	Students will apply descriptive and inferential statistical analysis techniques to analyze and interpret research data and understand the concept of hypothesis and its importance in research, and apply appropriate research methods.	**L1- Knowledge, L2- Understand**
CO4	Students will develop skills in technical writing, research reporting, and the proper structure and organization of research documents and	**L1- Knowledge, L2- Understand, L3- Apply**

	gain awareness of research ethics, academic integrity, and the importance of avoiding plagiarism and academic malpractice.	
CO5	This knowledge will increase interest in research and helpful for them to find out and design research projects.	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	This course help them how to set up objective and interpret data in research project.	**L1- Knowledge, L2- Understand, L3- Apply**

Course objective Sem I DSC – 3 (Microbiology Practical-I) PMB513P

1. Understand and application of isolation and purification protein technique
2. Evaluate enzyme activity determination of important hydrolytic enzymes
3. Learn technique of isolation and isolation of nitrogen fixing bacteria.

Course Outcomes Sem I DSC – 3 (Microbiology Practical-I) PMB513P

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	This course explains the enzyme activity determination of important hydrolytic enzymes	**L1- Knowledge/Remember, L2- Understand**
CO2	Students will learn about the effect of different physical factors	**L1- Knowledge, L2- Understand**
CO3	Students will able to isolate and purify the enzyme	**L1- Knowledge, L2- Understand**
CO4	Students will able to isolate and identify Nitrogen fixing bacteria such as Azotobacter, Rhizobium etc	**L1- Knowledge, L2- Understand L3- Apply,**
CO5	students will be able to isolate Siderophore producing bacteria	**L1- Knowledge, L2- Understand**
CO6	Students will learn about isolation and identification of rhizospheric microorganism	**L1- Knowledge, L2- Understand L3-Apply**

Course objective Sem I DSC – 4 (Microbiology Practical-II) PMB514P

1. Understand and apply various techniques of protein isolation and separation techniques
2. Learn techniques such northern blotting, gel filtration, SDS-PAGE etc
3. Understand the Estimation in various hematological technique hemoglobin, RBC,WBC count

Course Outcomes Sem I DSC – 4 (Microbiology Practical-II) PMB514P

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	This course explains the techniques of Genetics and protein biology	**L1- Knowledge/Remember, L2- Understand**
CO2	Students will learn about Subcellular organelles and isolation of Marker enzymes	**L1- Knowledge, L2- Understand**
CO3	The performance of various molecular techniques will be understood	**L1- Knowledge, L2- Understand**
CO4	Students will learn various techniques of protein isolation and analysis techniques	**L1- Knowledge, L2- Understand L3- Apply,**
CO5	Students will learn various techniques of protein isolation and analysis techniques	**L1- Knowledge, L2- Understand L3- Apply,**
CO6	Student will learn and apply this techniques in various pharma industry	**L1- Knowledge, L2- Understand L3- Apply**

Course Objective Sem I -Paper V (Microbial Methods for Environmental Management (MMEM)

1. This course emphasizes how the principles and techniques of environmental problems such as Bio magnification of chlorinated hydrocarbons and pesticides.
2. Understand concept and consequences of bioremediation, bioleaching etc its types and applications.
3. To describe recent advances in environmental monitoring such as Biomarker gene (antibiotic and heavy metal resistance genes, ice nucleation genes), Bioreporter genes competitive exams of government and also other environment institutes.

M.Sc. MICROBIOLOGY SEMESTER -II

Course Objectives Sem II- DSC – 5 (Medical Microbiology and Parasitology (MMP) PMB521T

1. Understand the fundamental principles of medical microbiology and parasitology, including the structure, function, and pathogenesis of microorganisms and parasites.
2. Explain the mechanisms of microbial and parasitic pathogenesis, including virulence factors, host-parasite interactions, and immune responses.
3. Describe and learn about new emerging infections like Streptococcus suis; community associated Methicillin resistant Staphylococcus aureus (MRSA)

Course Outcomes Sem II- DSC – 5 (Medical Microbiology and Parasitology (MMP) PMB521T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will gain good knowledge on Types, stages of infection, process of infection. Mechanism of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts	**L1- Knowledge/Remember, L2- Understand**
CO2	Students will also get knowledge on Morphological characteristics, Pathogenesis and Laboratory diagnosis of various pathogenic micro-organisms	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will learn about pathogenic bacteria pathogenic fungi , Parasites , Helminths	**L1- Knowledge, L2- Understand**
CO4	Students will also learn about New emerging infections like Streptococcus suis; community associated Methicillin resistant Staphylococcus aureus (MRSA), Bordetella pertusis, Clostridium difficile, Multi drug resistant tuberculosis.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will apply this knowledge of medical microbiology in various pathology lab testing.	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Students will apply this knowledge to design research project related to medical microbiology	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective Sem II- DSC – 6 (Immunology and Immunodiagnostics (IID) PMB522T

1. Understand the fundamental principles of immunology, including the structure and function of the immune system, immune cells, and immune responses.

2. Describe the role of immunological mechanisms in health and disease, including immune responses to infections, autoimmune diseases, and cancer.

3. Understand the principles and applications of immunodiagnostics, including serology, and molecular diagnostics.

Course Outcomes Sem II- DSC – 6 (Immunology and Immunodiagnostics (IID) PMB522T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to understand the Overview of the Immune system, Cells involved in immune system, brief concept	**L1- Knowledge/Remember, L2- Understand**

	of Hematopoiesis and about immune cells.	
CO2	Students will gain detail knowledge on Complement System, Inflammation, Cell Mediated Immunity Antibody-Dependent cell mediated cytotoxicity T-Cell dependent and T-cell independent defense mechanisms.Students will also get knowledge on Transplantation Immunology	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will understand the concepts of Immunodeficiency disorders, autoimmune diseases in detail	**L1- Knowledge, L2- Understand**
CO4	Students will learn about different immunodiagnostic techniques like Radioimmuno assay, ELISA, Immunofluorescence.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will apply knowledge of Immunology for tackling different immunological disorder	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Students will use knowledge in biomedical field understanding	**L1- Knowledge, L2- Understand, L3- Apply**

Course Outcomes Sem II DSE – 2 (Microbial Methods for Environmental Management (MMEM) PMB525T

Sr. No.	**Course Outcomes**	**Knowledge levels (Bloom's taxonomy)**
CO1	Students will be able to understand the microbial changes induced by organic and inorganic pollutants, factors influencing the eutrophication process and control of eutrophication. Students will also know about the concept of biodeterioration, biodeterioration of woods and pharmaceutical products	**L1- Knowledge/Remember, L2- Understand**
CO2	Students will understand the important things about the concept and consequences of Biomagnification of chlorinated hydrocarbons and pesticides.	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will learn about biotransformations of metals and metalloids, mercury transformations, biotransformation of pesticides such as hexachlorobenzene.	**L1- Knowledge, L2- Understand,**

CO4	Students will learn about the important branch of microbiology viz: Geomicrobiology in which they would gain detailed understanding of bioleaching of ores, leaching techniques and applications	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will understand the concept of Bioremediation, its types and applications. Biomarker gene (antibiotic and heavy metal resistance genes, ice nucleation genes), Bioreporter genes. This knowledge will be helpful for students during their research as the bioremediation approach is having great demand in research	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO6	After learning this course students will be benefited by the knowledge, they gain from it as it will be helpful for them in qualifying various competitive exams of government and also other environment institutes.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective Sem II DSE – 2 (Microbial Methods for Environmental Management (MMEM) PMB525T

1. Understand the diversity and complexity of microbial metabolites, including their structure, function, and biosynthesis.
2. Identify and characterize different types of microbial metabolites, such as antibiotics, pigments, toxins, and enzymes.
3. Explain the role of microbial metabolites in ecological interactions, including symbiosis, competition, and pathogenesis.

Course Outcomes Sem II DSC-2 (Microbial metabolites (MMT) PMB525T

Sr. No.	**Course Outcomes**	**Knowledge levels (Bloom's taxonomy)**
CO1	Students will be able to understand the important aspects of General account of metabolites, secondary metabolites. Classification, structure and mode of action of secondary metabolites. Plants secondary metabolites: Digitoxine, Salicylic acid, Mycotoxins-Aflatoxin, Ochratoxin,Patulin	**L1- Knowledge/Remember, L2- Understand**
CO2	Students will gain good knowledge on the structure and function of a variety of drugs used to control the growth of microorganisms and they will understand the mechanism of action of different drugs	**L1- Knowledge, L2- Understand, L3- Apply**

	like Aminoglycosides, Carbapenems, Microlids, Nitrofuran	
CO3	Students will also get knowledge on the structure and function of Hemoglobin, Myoglobin, Melanin and bile pigments. Microbial pigments: Bacteriochlorophylls, Carotenoids of prokaryotes, rhodopsin and accessory pigments (Pulcherrimin, indigoidin, voalecin) Defensive role of pigments	**L1- Knowledge, L2- Understand**
CO4	Knowledge on role of vitamins in life, structure, function and chemistry of different vitamins : Retinol (vitaminA), Riboflavin (vitaminB2), Cyanocobalamin (VitaminB12) and ascorbic acid (vitamin C) will help students to understand the mechanism of deficiency diseases.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	This course will be helpful for students in pharma company	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	The knowledge gained from this course will be helpful for students while facing the interviews in pharmaceutical industries.	

Course Objectives Sem II - DSC – 7 Microbiology Practical-III PMB523P

1. Understand and apply technique and methods of isolation and identification of pathogenic bacteria, fungi and parasites
2. learn Antibiotic sensitivity testing by various methods
3. to perform different staining techniques

Course Outcomes Sem II - DSC – 7 Microbiology Practical-III PMB523P

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	students will be able to perform different staining techniques	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will learn about isolation of pathogens from clinical samples	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO3	Students will learn conventional and rapid methods of isolation and identification of pathogenic bacteria, fungi and parasites	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO4	Students will learn Antibiotic sensitivity testing by various methods	**L1- Knowledge/Remember, L2- Understand, L3- Apply**

CO5	Students will apply this knowledge of medical microbiology in various pathology lab testing.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO6	Students will apply this knowledge of medical microbiology in various pathology lab testing	**L1- Knowledge/Remember, L2- Understand, L3- Apply**

Course Objectives Sem II DSC – 8 Microbiology Practical-IV PMB524P

1. Demonstrate hands-on skills in various immunological techniques, including:
   - Serological assays (e.g., ELISA, Western blot)
2. Perform and interpret immunological tests, including: Antibody detection and quantification
3. Develop critical thinking and problem-solving skills in the context of immunological experiments and data analysis

Course Outcomes Sem II DSC – 8 Microbiology Practical-IV PMB524P

Sr. No.	**Course Outcomes**	**Knowledge levels (Bloom's taxonomy)**
CO1	Students will learn principles & methods of diagnostic immunology immunodiffusion technique.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	students will be able to perform the	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO3	students will be able to perform the technique of immunoelectrophoresis.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO4	Students will be able to perform the technique of Enzyme linked immunosorbent assay (ELISA)	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO5	Students will apply this knowledge in during their project work	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO6	Students will use this knowledge during their jobs in pharma industry	**L1- Knowledge/Remember, L2- Understand, L3- Apply**

M.Sc. MICROBIOLOGY SEMESTER -III

Course Objectives: Sem III DSC – 9 Paper–IX Molecular Biology and Genetics PMB631T

1. This course developed concept about the mechanisms of DNA replication, transcription, and translation.
2. Explain the principles of gene expression and regulation.
3. Apply molecular biology techniques such as PCR, DNA sequencing, and gene cloning.

Course Outcomes: Sem III DSC – 9 Paper–IX Molecular Biology and Genetics PMB631T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to understand the Repair in Replication and Recombination	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will be able to understand the gene expression by transcription and translation process	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will gain the knowledge of the process of gene expression viz: Transcription, Post transcription modification and translation	**L1- Knowledge, L2- Understand L3- Apply**
CO4	Students will understand the important things about various types of DNA repair mechanisms in eukaryotes and prokaryotes	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will learn about the detailed concepts of operon systems in bacteria viz: Lac operon in E.coli and its regulation	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Students will also gain detailed knowledge on gene mapping by using conjugation, transduction and transformation. They will also know about bacteriophages and transposons and retroposons	**L1- Knowledge, L2- Understand**

Course Objectives: Sem III DSC – 10 Paper–X Recombinant DNA Technology and Nano-biotechnology PMB632T

1. Understand the principles and methods of recombinant DNA technology, including gene cloning and expression.
2. Analyze the applications of recombinant DNA technology in fields such as medicine, agriculture, and biotechnology.
3. Execute experiments involving recombinant DNA techniques, including PCR, DNA sequencing.

Course outcomes: Sem III DSC – 10 Paper–X Recombinant DNA Technology and Nano-biotechnology PMB632T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to understand the important aspects of r -DNA technology like cloning, gene sequencing, and other molecular tools.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will learn the important molecular techniques like polymerase chain reaction	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will also be able to understand important things about nanobiotechnology and its applications...	**L1- Knowledge, L2- Understand**
CO4	Students will also learn about tissue culture and stem cell technology	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Student will also learn about Gene therapy technique	**L1- Knowledge, L2- Understand**
CO6	This knowledge will increase students' interest in research based on molecular biology and in nano biotechnology. Knowledge of r -DNA technology and genetics will offer an opportunity for students to work in various molecular biology laboratories as a research person.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objectives: Sem III DSC – 11 Paper–XII Drugs and Disease Management PMB633T

1. Understand the principles of pharmacology, including pharmacokinetics, pharmacodynamics, and pharmacogenomics.
2. Analyze the relationship between drugs and diseases, including the mechanisms of drug action, side effects, and drug interactions.
3. Apply knowledge of pharmacotherapy to manage various diseases, including infectious diseases, chronic diseases.

Course Outcomes: Sem III DSC – 11 Paper–XII Drugs and Disease Management PMB633T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to understand the history and mechanism of action of various drugs.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will learn in detail about antifungal agents.	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will learn in detail about antitubercular agents	**L1- Knowledge, L2- Understand**
CO4	Students will learn n detail about antiprotozoal agents	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	They will also get knowledge on mechanism of drug resistance in microbes..	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	After learning this course student will be able to work on research projects based on drug microbe interaction and this knowledge of drugs will also help students to qualify various competitive exams like drug inspector etc.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objectives: Sem III DSE – 3(T) Paper–XI Microbial Diversity Evolution and Ecology-I PMB635T

1. Understand the scope and significance of microbial diversity, evolution, and ecology in various ecosystems.
2. Describe the fundamental principles of microbial evolution, including phylogeny, speciation, and adaptation.

3. Identify and characterize different types of microorganisms, including bacteria, archaebacteria

Course Outcomes: Sem III DSE – 3(T) Paper–XI Microbial Diversity Evolution and Ecology-I PMB635T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to understand the evolutionary processes and theories based on evolution	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will learn the important molecular techniques for determining the evolutionary relationships viz: 16S rRNA	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will get detailed knowledge on diversity of microorganisms	**L1- Knowledge, L2- Understand**
CO4	Students will also learn about Archaebacteria and its autotrophy	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	This knowledge will help students in their practicals and they can have an idea on classification of microbes, taxonomy.	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Student will get detailed knowledge about classical taxonomy and chemotaxonomy .	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objectives: Sem III DSE – 3(T) Bioinformatics (BIF) – I PMB635T

1. Understand the fundamental concepts of bioinformatics, including data analysis, computational tools, and biological databases.
2. Apply bioinformatics tools to analyse and interpret large-scale biological data, such as genomic sequences, gene expression data.
3. Analyse genomic sequences using various methods**,** Dot Plots, Simple alignments, Dynamic programming global and local alignments BLAST, FASTA**.**

Course Outcomes: Sem III DSE – 3(T) Bioinformatics (BIF) – I PMB635T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to understand the basic concepts of computer organization, Internet, Browser, Homepage, Web applications.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**

CO2	Students will learn the important aspects of databases and its types	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will get detailed knowledge on diversity of microorganisms	**L1- Knowledge, L2- Understand**
CO4	Students will also learn about genomics and gene recognition.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will learn the important consensus tress, comparison of phylogenetic methods.	**L1- Knowledge, L2- Understand**
CO6	This knowledge will be helpful while working on research projects. Students can get a job opportunity as a data analyst in research institutes and also in bio software developer companies	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective: Sem III DSC – 12 Practical –V Laboratory Exercise 5 PMB634P

1. Demonstrate hands-on skills in molecular biology techniques, including DNA extraction, PCR, gel electrophoresis.
2. Understand the principles and applications of various molecular biology techniques, including gene cloning, gene expression.
3. Design and execute molecular biology experiments, PCR optimization, RFLP technique.

Course Outcomes: Sem III DSC – 12 Practical –V Laboratory Exercise 5 PMB634P

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to isolate genomic and plasmid DNA.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will be able to amplify and restrict the DNA.	**L1- Knowledge, L2- Understand, L3- Apply**

CO3	Students will get the knowledge of bacterial transformation and cloning	**L1- Knowledge, L2- Understand**
CO4	Students will understand the basics of mutation	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will be able to understand and apply the amplification technique of Polymerase Chain Reaction (PCR)	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Student will able to demonstrate skills in RFLP analysis, including DNA extraction, restriction digestion, and gel electrophoresis.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective: Sem III DSE – 3(P) Practical –VI Laboratory Exercise 6 Elective Practical PMB635P

1. Learn how to isolate extremophiles.
2. Understand microbial diversity by using bioinformatics.
3. Learn about soil microbes and their PGPR traits.

Course Outcomes: Sem III DSE – 3(P) Practical –VI Laboratory Exercise 6 Elective Practical PMB635P

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to isolate Halophiles.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will be able to isolate methanogen and acidophilic.	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will get the knowledge about phosphate solubilizing bacteria.	**L1- Knowledge, L2- Understand**
CO4	Students will understand the basics of bioinformatics various tools.	**L1- Knowledge, L2- Understand, L3- Apply**

CO5	Student will get knowledge about the phylogenetic analysis of species by DNA and Protein sequencing	**L1- Knowledge, L2- Understand**
CO6	Student will also get knowledge about denitrifying bacteria.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective: RP Research Project PMB638P

1. Design and propose a primary research project, including formulation of a research question, hypothesis, and objectives.
2. Conduct a comprehensive literature review to inform the research project.
3. Develop a research methodology including selection of research design, sampling strategy, and data collection methods.

Course Outcomes:

Sr. No.	**Course Outcomes**	**Knowledge levels (Bloom's taxonomy)**
CO1	Students will learn how to do literature survey and to plan	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will learn about methodology and design of project.	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will perform research work on various topics that will impart deeper knowledge of facts & methods in Microbiology / life science.	**L1- Knowledge, L2- Understand**
CO4	Students will be capable of contributing to research and development work.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will be able to plan how to write synopsis about project.	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Students will be able to performed primary level studies about research project.	**L1- Knowledge, L2- Understand, L3- Apply**

M.Sc. MICROBIOLOGY SEMESTER -IV

Course Objective: Sem IV DSC – 13 Paper–XIII – Virology PMB641T

1. Understand the fundamental principles of virology, including virus structure, classification, and replication.
2. Describe the mechanisms of viral transmission, pathogenesis, and immune response.

3. Identify and characterize different types of viruses, including DNA and RNA viruses, and their associated diseases.

Course Outcomes: Sem IV DSC – 13 Paper–XIII – Virology PMB641T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will learn in detail about Brief outline on discovery of viruses (Origin and evolution), Terminology, Differentiation with other groups of microorganisms	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	The course also covers detailed knowledge on Morphology and structure of viruses (size and shape/symmetry).Chemical composition of viruses (viral capsid, spikes, envelopes and types of viral nucleic acids). Assay of Viruses etc.	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will also understand about bacterial viruses which includes Bacteriophages- Structural organization; life cycle (Extracellular phase; attachment, penetration of nucleic acid, transcription, translation, replication, maturation and release of phage particles) of ΦX174,T4,lambda, M13 etc	**L1- Knowledge, L2- Understand**
CO4	Students will also learn about life cycle, pathogenesis and laboratory diagnosis of plants and animal viruses which is very important for them as sometimes they have to work on research projects related to plants and animal diseases.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will also learn about General, Serological and Molecular methods of diagnosis of viruses	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Students will also learn about Antiviral agents, non-nucleoside RT inhibitors a Protease inhibitor.	**L1- Knowledge, L2- Understand**

Course Objective: Sem IV DSC – 14 Paper–XIV Microbial Fermentation and Technology PMB642T

1. Understand the principles of microbial fermentation, including types of fermentation, microbial growth, and metabolism.
2. Describe the equipment and instrumentation used in fermentation processes, including bioreactors and fermenters.
3. Explain the factors affecting fermentation processes, including pH, temperature, oxygen levels, and nutrient supply.
4. Develop skills in fermentation techniques, including inoculum preparation, sterilization, and fermentation optimization.

Course Outcomes: Sem IV DSC – 14 Paper–XIV Microbial Fermentation and Technology PMB642T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will learn in detail about Bioreactors, its types, etc.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	The course also covers detail knowledge on Growth kinetics and Monod's Model, Substrate accelerated death, specific growth rate, stringent response, Ntr and Pho system, growth limiting substrate, maintenance energy, growth yield and product formation	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will also understand about downstream processes: types of processing units and systems, Storage and packaging methods.	**L1- Knowledge, L2- Understand**
CO4	Course also covers information about scale up and downstream processes	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Course also includes important methods for production of valuable products viz: Biofuels, antibiotics, organic acids, and also food and healthcare products	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Student will learn about all fermentation technology and its used for the further research project.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective: Sem IV DSC-15 Paper–XVI Vaccines and Delivery System PMB643T

1. Understand the principles of vaccine and drug delivery systems, including types of vaccines and drugs, and their mechanisms of action.
2. Describe the methods used to design, develop, and evaluate vaccine and drug delivery systems, including pharmaceutical approaches.
1. 3.Understand the drug designing and drug delivery systems in preventing against different diseases

Course Outcomes: Sem IV DSC-15 Paper–XVI Vaccines and Delivery System PMB643T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will learn the important aspects of Vaccines such as Definition and discovery of vaccines. Active and passive prophylactic measures.	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will also learn about the Contents and immunization schedule of important vaccines viz: BCG, Hepatitis vaccine, Influenza vaccine, Polio vaccine (Inactivated,live attenuated),DPT MMR etc	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will also learn about the Advanced vaccines viz: HIV vaccines, Herpes simplex viral vaccines etc	**L1- Knowledge, L2- Understand**
CO4	This course also covers important aspects of the Drugs & vaccines delivery system.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Course also includes important methods for production of valuable products viz : Biofuels, antibiotics, organic acids, and also food and healthcare products	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Student will get detailed knowledge about the vaccine, different type of vaccine and new drug delivery system and used for further research studies.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective: Sem IV DSE – 4 Paper–XV Microbial Diversity Evolution and Ecology- II PMB645T

1. Analyse the interactions between microorganisms and their environments, including symbiotic relationships and nutrient cycling.
2. Understand the principles of biostatistics, including types of data, statistical distributions, and hypothesis testing.
3. Describe the concepts of probability, sampling and genetic structure of population

Course Outcomes: Sem IV DSE – 4 Paper–XV Microbial Diversity Evolution and Ecology- II PMB645T

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will understand in detail about concepts of Microbial Ecosystems, Population, communities, homeostasis,	**L1- Knowledge/Remember, L2- Understand, L3- Apply**

	Diversity indices, dominance indices, information statistics indices, Shannon index, Brillouin Index, Learn about genetic structure of population & Hardy-Weinberg Law	
CO2	Students will learn about different microbial interactions like Competition, coexistence, syntrophy , commensalism, Mutualism, predation, parasitism, antagonism.	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will understand the concept of sustainable development	**L1- Knowledge, L2- Understand**
CO4	Students will learn methods of sampling, Collection & Presentation of statistical data,. This will help them to handle the data collected during their research work.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Student will learn about Standard deviation, phylogenetic clustering this technique used for the research purpose	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Student will learn about microbial diversity, evolution, ecology and all principle used for data analysis. they help them for research purpose.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objectives: Sem IV DSE – Bioinformatics (BIF) – II

1. Learn the important aspects Data Mining, data mining problems, cluster analysis, data mining techniques and tools, data mining methods.
2. Learn the structure of proteins, protein motifs and folding, protein folding modeling, protein structure prediction.
3. Understand the structure of RNA, types of RNA, RNA structure prediction.

Course Outcomes: Sem IV DSE – Bioinformatics (BIF) – II

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will be able to understand the advanced concepts of data mining and different methods of it	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will learn predict the protein structure	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will get detailed knowledge on RNA structure prediction	**L1- Knowledge, L2- Understand**

CO4	Students will also learn about computer aided drug designing	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will learn the post translational modification prediction	**L1- Knowledge, L2- Understand**
CO6	This course will ultimately increase the knowledge of students about the advanced bioinformatics tools	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective: Sem IV DSC – 16 Practical –VII Laboratory Exercise 7 PMB644P

1. Learn how to isolate bacteriophage using plaque assays techniques.
2. Learn the production of antibiotics and its estimation.
3. Understand concept of immobilization of cell and enzymes.

Course Outcomes: Sem IV DSC – 16 Practical –VII Laboratory Exercise 7 PMB644P

Sr. No.	**Course Outcomes**	**Knowledge levels (Bloom's taxonomy)**
CO1	Students will learn how to Isolate viruses from water sources	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will learn how to carry out microbiological examinations of food samples.	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	This course also covers Production of penicillin in the lab and its estimation	**L1- Knowledge, L2- Understand**
CO4	Students will understand Determination of microbial reaction kinetics in a fed batch system	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will perform experiment on determination of the parameters of oxygen transfer.	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Students will also learn about how to Immobilize Enzymes.	**L1- Knowledge, L2- Understand, L3- Apply**

Course Objective: Sem IV RP Practical –VIII Project Work PMB648P

1. Design and propose a research project or innovative solution to a real-world problem.

2. Conduct literature reviews and analyze existing research related to the project topic.
3. Develop a project plan including timelines, milestones, and resource allocation.

Course Outcomes: Sem IV RP Practical –VIII Project Work PMB648P

Sr. No.	Course Outcomes	Knowledge levels (Bloom's taxonomy)
CO1	Students will learn how to do literature survey and to plan	**L1- Knowledge/Remember, L2- Understand, L3- Apply**
CO2	Students will learn how to locate a problem	**L1- Knowledge, L2- Understand, L3- Apply**
CO3	Students will perform research work on various topics that will impart deeper knowledge of facts & methods in Microbiology / life science.	**L1- Knowledge, L2- Understand**
CO4	Students will be capable of contributing to research and development work.	**L1- Knowledge, L2- Understand, L3- Apply**
CO5	Students will be able to plan and use adequate methods to conduct qualified tasks in given frameworks	**L1- Knowledge, L2- Understand, L3- Apply**
CO6	Students will be able to clearly present and discuss the conclusions as well as the knowledge and arguments that form the basis for these findings. They will learn to evaluate their work..	**L1- Knowledge, L2- Understand, L3- Apply**

Course outcomes of MSc Chemistry

Shiksha Mandal's
Bajaj College of Science, Wardha
Syllabus of M.Sc. I Semester I
DSC I (Theory)
PGCH1T1: Inorganic Chemistry
[60 Hrs] [4 Credits]
Course Objectives

1. Understand the stereochemistry and bonding of various molecules on the basis of various theories viz. VSEPR theory, Crystal field theory and Molecular orbital theory.
2. Determine the structure of complex using electronic spectra and magnetic susceptibility

measurement studies.

3. Understand the structure, bonding and topology of boron hydrides and its application.
4. Determine the classification of metal clusters containing metal-metal bonds and learn about the factors affecting the stability of metal complexes.
5. Learn about the isopolyacids and heteropolyacids and their structures.
6. Describe the role of metal in biological system and their function.
7. Describe the structural and functional relationships, mechanisms and importance of metalloenzymes.

Course Outcomes

This will equip the learners to gain understanding of:

1. Importance of various theories in determining the stereochemistry and bonding of various molecules.
2. Magnetic and electronic properties of complexes for structure elucidation.
3. Structure and reactivity of boranes, stability of metal clusters and structures of iso and heteropolyacids.
4. Validate the role of bioinorganic chemistry in every day action.

DSC II (Theory)

PGCH1T2: Physical Chemistry

[60 Hrs] **[4 Credits]**

Course Objectives

1. To recapitulate fundamentals of chemical thermodynamics and extending the study to Maxwell's relations and third law of thermodynamics.
2. To learn advanced concepts and theories of chemical kinetics.
3. To understand fundamentals of quantum mechanics and its applications.
4. To study theories of electrolytes and fundamentals of conductometry, potentiometry and their applications.

Course Outcomes

On successful completion of this Course the students should be able to-

1. Derive the Maxwell's relations and understand third law of thermodynamics and related concepts.
2. Learn modern concepts and theories of reaction dynamics.
3. Understand and execute quantum mechanical problems and their applications
4. Understand the theories of electrolytes, apply conductometric and potentiometric titrations for analysis

DSC III (Practical)

PGCH1P1: Inorganic Chemistry Practical

[60 Hrs] **[2 Credits]**

Course Objectives

1. To conduct the experiments for the preparation and characterization of metal complexes.
2. To conduct separation and determination of two metal ions from different alloys using Volumetric, Gravimetric and Spectrophotometric methods.
3. To conduct qualitative analysis of inorganic mixture containing total of five radicals including interfering radicals.

Course Outcomes

1. Students will learn to synthesize various inorganic compounds, purify and characterize them.
2. Students will also be able to perform qualitative and quantitative analysis of different

compounds and mixtures.

DSC IV (Practical)

PGCH1P2: Physical Chemistry Practical

[60 Hrs] [2 Credits]

Course Objectives

The most important objective of this course is to apply theoretical principles to conduct various physic-chemical studies of somesystems. The students should learn to apply non-instrumental and instrumental techniques for better understanding of physical chemistry concepts.

Course Outcomes

After completing this course, the students will-

1) Learn the determination of important quantities of liquids such as volume contraction on mixing and activation parameters of viscous flow.
2) Understand the determination of the critical micelle concentration (CMC) of a given surfactant and molecular mass of a polymer.
3) Know how to determine heat of dilution and also study effect of impurity on CST in phenol-water systems.
4) Understand determination of distribution coefficient, know how to construct the phase diagrams of two components system, find the mutual solubility of glycerol-*m*-toluidine.
5) Be able to determine rate constant, equilibrium constant and order of various reactions.
6) Learn to employ conductometry, potentiometry and pH metry for different studies.

College of Science, Wardha Syllabus of M.Sc. I
Semester I ELECTIVE - I

PGCH1E1: Bonding, Stereochemistry and Nucleophilic Substitutions

[60 Hrs] [4 Credits]

Course Objectives

To learn

1. Basic idea about important electronic effects in organic chemistry, reactive intermediate, aromaticity.
2. 3-D aspect of organic molecules such as optical activity of asymmetric and dissymmetric molecules.
3. aliphatic nucleophilic substitution reaction.
4. aromatic nucleophilic and electrophilic substitution reactions.

Course Outcomes

Students will gain an understanding of:

1. fundamental knowledge of reactive intermediate, chemical bonding & aromaticity.
2. 3-D aspects of organic molecules.
3. aliphatic nucleophilic substitution reaction.
4. aromatic nucleophilic and electrophilic substitution reactions.

ELECTIVE - II

PGCH1E2: Polymer Chemistry I

[60 Hrs] [4 Credits]

Course Objectives

The main objectives of this course are

- To study basic concept, raw materials, nomenclature and classification of polymers along with types of polymerization with their mechanisms
- To understand concepts of polymer molar mass and important methods of determination.
- To realize important physical characteristics of polymers
- To learn about synthesis and application of some commercial and functional polymers

Course Outcomes

At the end of this course, students will-

- Be abreast with basic concept, raw materials, nomenclature and classification of polymers. of polymers.
- Understand types of polymerization with their mechanisms
- Realize concepts of polymer molar mass and important methods of determination.
- Gain an understanding of important physical characteristics of polymers
- Have the knowledge about synthesis and application of some commercial and functional polymers

PGCH1RM: Research methodology

[4 Credits]

Course Objectives

1. Gain a comprehensive understanding of research methodology and its fundamental concepts.
2. Acquire skills in data collection, analysis, and interpretation using various statistical techniques.
3. Develop the ability to critically evaluate and select appropriate research methods for different types of research.
4. Enhance proficiency in technical writing, research reporting, and adherence to research ethics and academic integrity.

Course Outcomes

After learning research methodology course, students will be able to:

1. Identify and describe the characteristics of different types of research, including basic, applied, and patent-oriented research.
2. Apply descriptive and inferential statistical analysis techniques to analyze and interpret research data and its importance in research, and apply appropriate research methods.
3. Apply scientific thinking and problem identification techniques in the research process.
4. Develop skills in technical writing, research reporting, and the proper structure and organization of research documents and gain awareness of research ethics, academic integrity, and the importance of avoiding plagiarism and academic malpractice

Shiksha Mandal's
Bajaj College of Science, Wardha
Syllabus of M.Sc. I Semester II
DSC V (Theory)
PGCH2T1: Organic Chemistry
[60 Hrs] [4 Credits]
Course Objectives
To learn

1. various addition reactions across C-C, C-O and C-N multiple bonds.
2. basic concepts in molecular rearrangement & elimination reaction.
3. types and mechanism of free radical reactions.
4. principles and advantages of green chemistry.

Course Outcomes
Students will gain an understanding of:

1. various addition reactions across C-C, C-O and C-N multiple bonds.
2. basic concepts in molecular rearrangement & elimination reaction.
3. types and mechanism of free radical reactions.
4. principles and advantages of green chemistry.

DSC VI (Theory)

PGCH2T2: Analytical Chemistry
[60 Hrs] [4 Credits]
Course Objectives
The primary objective of this course is to acquire basic concepts, principles, and techniques of modern analytical chemistry that would empower students with an analytical mind set and the abilities to solve diverse analytical problems in an efficient and quantitative way that conveys the importance of accuracy and precision of the analytical results. The Course is aimed at-

1. Studying Introduction to analytical chemistry.
2. Gaining knowledge of classical methods of analysis.
3. Understanding Separation Techniques, Chromatography, Ion exchange and Solvent extraction.
4. Knowing Electroanalytical Methods of Analysis – conductometry & Potentiometry.
5. Knowing optical methods of Analysis – Spectrophotometry and Colorimetry

Course Outcomes

1. Express the role of analytical chemistry in science.
2. Explain the fundamentals of analytical chemistry and steps of a characteristic analysis.
3. Compare & express qualitative and quantitative methods.
4. Understanding fundamentals of Separation techniques like Chromatography & solvent extraction.
5. Explain the theoretical principles and important applications of classical analytical methods within titration (acid/base titration, complexometric titration, redox titration, precipitation titration), and various techniques within gravimetric methods.
6. Realize the theoretical principles of electroanalytical & optical techniques conductometry, Potentiometry, Spectrophotometry and Colorimetry

DSC VII (Practical)
PGCH2P1: Organic Chemistry Practical
[60 Hrs] [2 Credits]
Course Objectives
To learn the purification techniques (solvents & reagents), qualitative analysis of two component mixture & organic preparation of single step & two step synthesis.

Course Outcomes
Students will gain an understanding of:

1) Separation and analyze the different component mixtures of simple organic compounds.
2) Purification, Crystallization, and different Distillation processes.
3) How to calculate a limiting reagent, yield, and percent yield
4) Synthesis using substitution and condensation reactions.
5) Single step & multistep synthesis.

Shiksha Mandal's

Bajaj College of Science, Wardha Syllabus of
M.Sc. I Semester II ELECTIVE - I

PGCH2E1: Reaction Mechanism, π-Complexes and Clusters

[60 Hrs] **[4**

Credits]

Course Objectives

1. Analyse the reactivity of transition metal complexes.
2. Analyse the reaction pathways of complex formation understand its reaction mechanism.
3. Study the preparation, structures and properties of metal carbonyls and metal nitrosyls and the chemistry of dioxygen and dinitrogen complexes.
4. Understand the classification of metal clusters containing metal-metal bonds.
5. Learn about the isopolyacids and heteropolyacids and their structures.

Course Outcomes

The learner will gain knowledge of:

1. Reaction mechanism governing the substitution reaction substitution and electron transfer reactions in transition metal complexes.
2. Structure and bonding in metal carbonyls and metal nitrosyls.
3. Occurrence of metal-metal bonds in metal clusters and its significance.

ELECTIVE - II

PGCH2E2: Polymer Chemistry II

[60 Hrs] [4 Credits]

Course Objectives

- To reinforce the basic concepts of polymer chemistry including polymerization processes and techniques, polymer architectures, configuration and conformation of polymers etc.
- To learn the spectroscopic, thermal and thermochemical techniques for characterization of polymers.
- To study briefly few examples of biomedical, inorganic, coordination and diene based polymers

Course Outcomes

On successful completion of this course, student should

- Understand the important basic concepts of polymer chemistry
- Know the types and techniques of polymerization processes
- Gain knowledge about important polymer characterization techniques

Know synthesis and application of some important biomedical, inorganic, coordination and diene based polymers

Syllabus of M.Sc. II Semester III

DSC IX (Theory)

PCH631T: Organic Special I

[60 Hrs] [4 Credits]

Course Objectives

1. To learn the theory/principal of photochemistry, types of photochemical reactions and its applications in organic synthesis.
2. To understand the basis of pericyclic reactions, its types and applications in chemistry.
3. To know the chemistry of some famous oxidizing and reducing agents in organic chemistry with major focus on its synthesis and synthetic applications.
4. To study chemistry of some phosphorous, sulphur, silicon and boron compounds with respect to its preparation, synthetic applications and stereochemistry.

Course Outcomes

By the completion of the above course the students will be able to

1. Recognize concept of photochemistry and will demonstrate its applications in organic synthesis.
2. Reproduce pericyclic reactions, its types and will implement its applications in chemistry.
3. Report the synthesis and evaluate the applications of some oxidizing and reducing agents in organic chemistry.
4. Recognize the chemistry of some phosphorous, sulphur, silicon and boron compounds along with its applications.

DSC X (Theory)

PCH632T: Organic Special II

[60 Hrs]

[4 Credits]

Course Objectives

1. To learn the terpenoids and porphyrins with major focus on their classification, occurrence, structure determination, stereochemistry and synthesis.
2. To understand the biology, role, classification, structure determination, stereochemistry, synthesis and biosynthesis of some alkaloids and prostaglandins.
3. To learn the steroids and plant pigments with respect to their occurrence, isolation, nomenclature, structure determination and synthesis.
4. To learn the chemistry of some biomolecules like carbohydrates, amino acids, proteins and peptides with respect to their types, structures, derivatives, structure determination.

Course Outcomes

By the completion of the above course, the students will be able to

1. Report the classification, occurrence, structure determination, stereochemistry and synthesis of terpenoids and porphyrins.
2. Illustrate the role, classification, structure determination, stereochemistry, synthesis and biosynthesis of some alkaloids and prostaglandins.
3. Reproduce the chemistry of steroids and plant pigments.
4. Recognise the classification, structure and chemistry of some biomolecules

like carbohydrates, amino acids, proteins and peptides.

DSC XI (Theory)

PCH633T: Spectroscopy

[60 Hrs]

[4 Credits]

Course Description

This course is introduced to impart the knowledge of various spectroscopic techniques such as Microwave, IR, Raman, and Mossbauer spectroscopy along with diffraction techniques and group theory to the students.

Course Objectives

The main objectives of the course are –

1. To relate important concepts related to symmetry elements and symmetry operations with spectroscopy.
2. To provide the basic knowledge about the principles and instrumentation of these spectroscopic techniques - Microwave, IR, Raman, and Mossbauer spectroscopy - along with their application for the structure elucidation of different organic and inorganic compounds.
3. To study the principles behind various diffraction techniques such as X-ray, neutron and electron diffraction.

Course Outcomes

On completion of theory course, students will be able to:

1. Recognize symmetry elements and symmetry operations and describe the multiplication table of C_{2V}, C_{3V} and character tables of H_2O and NH_3 using great orthogonality theorem.
2. Interpret spectra and identify compounds using Microwave and Mossbauer spectroscopy.
3. Determine the functional group and structure of compounds using IR, and Raman spectroscopy.
4. Analyse the nature and structure of samples using diffraction techniques viz. X-ray, electron, and neutron diffraction.

DSC XII (Practical)

PCH634P: Special Organic Chemistry Practical

[60 Hrs] **[2 Credits]**

Course Objectives

The main objective of this course is to

- Study the quantitative estimation organic compound, isolation of organic compound from natural source & qualitative analysis of mixture of three organic compound.

- Provide basic knowledge of principle and techniques of separation, purification and identification of ternary mixture of organic compounds.
- Perform qualitative analysis for a separation and identification of the components of a mixture of three organic compounds.

Course Outcomes:

The students will be able to

1. Demonstrate quantitative estimation of vitamin —C‖, formaldehyde, phenol, amine, glucose & carbonyl compounds.
2. Isolate an organic compound (caffeine, casein, dipricrate, β-carotene etc.) from natural source (tea leaves, milk, tobacco, carrot etc.)
3. Analyse qualitatively a separation and identification of the components of a mixture of three organic compounds.

Shiksha Mandal's

Bajaj College of Science, Wardha Syllabus of
M.Sc. II Semester III ELECTIVE - I

PCH635T: Modern Separation Techniques and Instrumental Analysis

Course Description

This course aims to provide students with a comprehensive understanding of instrumental
methods of analysis, enabling them to apply these techniques effectively in research, industry, and various scientific disciplines.

Course Objectives

The Course is aimed at-

1. **Instrumentation Familiarity:** To introduce students to a range of modern analytical instruments and techniques used in chemical analysis, such as spectroscopy, chromatography, and electrochemical methods.
2. **Instrumental Operation:** To teach students the principles of operation, components, and maintenance of various analytical instruments, ensuring they can use them effectively and safely.
3. **Calibration and Standardization:** To instruct students on how to calibrate instruments, create calibration curves, and use standards for accurate and precise measurements.
4. **Quantitative Analysis:** To develop students' ability to quantitatively determine the concentration of specific analytes in a sample using various instrumental methods.
5. **Data Analysis and Interpretation:** To equip students with the skills needed to analyze, interpret, and present data obtained from instrumental methods, including statistical analysis and error propagation.

Course Outcomes

Course outcomes for a course on Instrumental Methods of Analysis are

designed to specify the knowledge, skills, and abilities that students should gain upon completing the course. Here are some typical course outcomes for such a course:

1. **Understanding of Instrumentation:** Students should demonstrate a solid understanding of the principles and operation of various analytical instruments commonly used in chemical analysis, such as spectroscopy, chromatography, and electrochemical methods.
2. **Instrument Selection:** Students should be able to select the most appropriate analytical instrument or technique for a given analytical problem based on its strengths, limitations, and suitability for specific sample types.
3. **Instrument Calibration:** Students should have the ability to calibrate analytical instruments accurately, including setting up calibration curves, determining instrument sensitivity, and ensuring proper instrument performance.
4. **Data Analysis:** Students should be capable of performing data analysis, including peak integration, spectral interpretation, and statistical analysis, to extract meaningful information from instrument-generated data.

Shiksha Mandal's
Bajaj College of Science, Wardha
Syllabus of M.Sc. II Semester III
DSC IX (Theory)
PCH631T: Organic Special I
[60 Hrs] [4 Credits]

Course Objectives

1. To learn the theory/principal of photochemistry, types of photochemical reactions and its applications in organic synthesis.
2. To understand the basis of pericyclic reactions, its types and applications in chemistry.
3. To know the chemistry of some famous oxidizing and reducing agents in organic chemistry with major focus on its synthesis and synthetic applications.
4. To study chemistry of some phosphorous, sulphur, silicon and boron compounds with respect to its preparation, synthetic applications and stereochemistry.

Course Outcomes

By the completion of the above course the students will be able to

1. Recognize concept of photochemistry and will demonstrate its applications in organic synthesis.
2. Reproduce pericyclic reactions, its types and will implement its applications in chemistry.
3. Report the synthesis and evaluate the applications of some oxidizing and reducing agents in organic chemistry.
4. Recognize the chemistry of some phosphorous, sulphur, silicon and boron compounds along with its applications.

DSC X (Theory)
PCH632T: Organic Special II

[60 Hrs] [4 Credits]

Course Objectives

1. To learn the terpenoids and porphyrins with major focus on their classification, occurrence, structure determination, stereochemistry and synthesis.
2. To understand the biology, role, classification, structure determination, stereochemistry, synthesis and biosynthesis of some alkaloids and prostaglandins.
3. To learn the steroids and plant pigments with respect to their occurrence, isolation, nomenclature, structure determination and synthesis.
4. To learn the chemistry of some biomolecules like carbohydrates, amino acids, proteins and peptides with respect to their types, structures, derivatives, structure determination.

Course Outcomes

By the completion of the above course, the students will be able to

1. Report the classification, occurrence, structure determination, stereochemistry and synthesis of terpenoids and porphyrins.
2. Illustrate the role, classification, structure determination, stereochemistry, synthesis and biosynthesis of some alkaloids and prostaglandins.
3. Reproduce the chemistry of steroids and plant pigments.
4. Recognise the classification, structure and chemistry of some biomolecules like carbohydrates, amino acids, proteins and peptides.

DSC XI (Theory)
PCH633T: Spectroscopy
[60 Hrs] [4 Credits]

Course Description

This course is introduced to impart the knowledge of various spectroscopic techniques such as Microwave, IR, Raman, and Mossbauer spectroscopy along with diffraction techniques and group theory to the students.

Course Objectives

The main objectives of the course are –

1. To relate important concepts related to symmetry elements and symmetry operations with spectroscopy.
2. To provide the basic knowledge about the principles and instrumentation of these spectroscopic techniques - Microwave, IR, Raman, and Mossbauer spectroscopy - along with their application for the structure elucidation of different organic and inorganic compounds.
3. To study the principles behind various diffraction techniques such as X-ray, neutron and electron diffraction.

Course Outcomes

On completion of theory course, students will be able to:

1. Recognize symmetry elements and symmetry operations and describe the multiplication table of C2V, C3V and character tables of H2O and NH3 using great orthogonality theorem.
2. Interpret spectra and identify compounds using Microwave and Mossbauer spectroscopy.
3. Determine the functional group and structure of compounds using IR, and Raman spectroscopy.
4. Analyse the nature and structure of samples using diffraction techniques viz. X-ray, electron, and neutron diffraction.

DSC XII (Practical)
PCH634P: Special Organic Chemistry Practical
[60 Hrs] [2 Credits]

Course Objectives
The main objective of this course is to
- Study the quantitative estimation organic compound, isolation of organic compound from natural source & qualitative analysis of mixture of three organic compound.
- Provide basic knowledge of principle and techniques of separation, purification and identification of ternary mixture of organic compounds.
- Perform qualitative analysis for a separation and identification of the components of a mixture of three organic compounds.

Course Outcomes:
The students will be able to
1. Demonstrate quantitative estimation of vitamin —C‖, formaldehyde, phenol, amine, glucose & carbonyl compounds.
2. Isolate an organic compound (caffeine, casein, dipricrate, β-carotene etc.) from natural source (tea leaves, milk, tobacco, carrot etc.)
3. Analyse qualitatively a separation and identification of the components of a mixture of three organic compounds.

ELECTIVE - II
PCH635T: Environmental Chemistry I

The course is designed to make students aware of the chemistry behind environmental aspects like atmosphere, pollution of water and air. Students will learn sampling of polluted water, air, soil and investigate them chemically.

Course Objectives
The course is designed with following course objectives -
- To learn about atmosphere, relation of air pollution with climate change and analysis of air pollution.
- To learn about water resources, water pollution and important water analysis methods.
- To understand soil chemistry, soil management and effect of pesticides.

Course Outcomes
The expected course outcomes are given below:
1. Students will correlate air pollution with climate change and analyse the quality of air.
2. Students will explain water management methods and apply analytical skills to test the water samples.
3. Students will determine the type of soil, demonstrate correct techniques of soil management and investigate the effect of pesticides.

ELECTIVE - III
PCH635T: Medicinal Chemistry I

This course is aimed at keeping the students abreast with important developments in medicinal chemistry. The students will be introduced with important methods and

procedure followed in drug design and some drug types. Students will practically analyse and synthesize some common drugs.

Course Objectives
The main objectives of this course are
- To study basic concepts related to drug design and to understand important aspects of pharmacokinetics and pharmacodynamics.
- To realize mode of action and synthesis of some common diuretics, analgesics and antipyretics.
- To learn about synthesis and uses of important cardiovascular drugs and antineoplastic agent.

Course Outcomes
At the end of this course -
1. Students will illustrate a clear comprehension of fundamental concepts in drug design, including the principles of molecular interactions, target identification, and drug discovery strategies.
2. Students will apply key principles of pharmacokinetics and pharmacodynamics to analyze drug absorption, distribution, metabolism, and excretion, as well as the drug's effects on the body.
3. Students will apply their knowledge of cardiovascular drug synthesis and usage, as well as antineoplastic agent synthesis and application in the context of clinical scenarios.

Syllabus of M.Sc. II Semester IV
DSC XIII (Theory)
PCH641T: Organic Chemistry Special III
[60 Hrs] [4 Credits]
Course Objectives
The main objective of this course is to
1. Learn the carbanion chemistry and its applications in various organic name reactions.
2. Study the properties, synthesis and applications of various organometallic reagents of Li, Mg, Zn, Cu, Hg etc. and some transition metals in organic chemistry.
3. Understand the applications of advanced stereochemistry and protection/deprotection of functional groups in organic chemistry.
4. Design the organic synthesis based on retrosynthetic analysis.

Course Outcomes
By the completion of the above course the students will be able to
1. Recognise the carbanion chemistry and will analyze its applications in various organic name reactions.
2. Describe the properties, synthesis and applications of various organometallic reagents of Li, Mg, Zn, Cu, Hg etc. and some transition metals in organic chemistry.
3. Demonstrate the applications of advanced stereochemistry and protection/deprotection of functional groups in organic chemistry.
4. Develop a synthetic route for organic synthesis based on retrosynthetic analysis.

DSC XIV (Theory)

PCH642T: Organic Chemistry Special IV
[60 Hrs] [4 Credits]

Course Objectives

The main objective of this course is to provide

1. Fundamental knowledge of enzymes and its catalysis in biological systems.
2. Knowledge of chemistry of some heterocyclic compounds with major focus on their synthesis and reaction.
3. Information of the chemistry of bioactive compounds and biomolecules like nucleic acids, lipids and vitamins.
4. Knowledge of chemistry of some dyes, drugs and polymers with respect to its classification, structure and applications.

Course Outcomes

By the completion of the above course the students will be able to

1. Recognise chemistry of enzymes and its catalysis in biological systems with mechanistic details.
2. Demonstrate the chemistry of some heterocyclic compounds (like azoles, diazenes, benzofused heterocycles) with major focus on their synthesis and reactions.
3. Reproduce the chemistry of bioactive compounds and biomolecules like nucleic acids, lipids and vitamins.
4. Recall the chemistry of some dyes, drugs and polymers with respect to its classification, structure and applications.

DSC XV (Theory)
PCH643T: Spectroscopy
[60 Hrs] [4 Credits]

Course Objectives

1. To understand fundamental principles, important techniques and applications of ultraviolet -visible spectroscopy and Photoelectron spectroscopy.
2. To study important concepts related to ESR spectroscopy and mass spectrometry and to understand the interpretation of the spectral data.
3. To know fundamental principles, important techniques and applications of nuclear magnetic resonance spectroscopy and to learn the structure determination of organic molecules by applying 2D-NMR spectroscopy, COSY, HETCOR, NOSEY, DEPT-45, DEPT-90, DEPT-135 etc.
4. To learn to solve the numerical based on the combined spectral data.

Course Outcomes

On completion of theory Course, students will:

1. Describe basic principles and applications of UV visible and photoelectric spectroscopy.
2. Apply principles of ESR spectroscopy and mass spectrometry for structure determination of organic molecules.
3. Explain important concepts of NMR spectroscopy and illustrate FT- NMR, COSY, HECTOR, NOSEY, DEPT, INEPT, APT, INADEQUATE techniques.
4. Elucidate the structure of organic molecules by using combined spectral data of UV, IR, NMR, and mass spectroscopy.

DSC XVI (Practical)
PCH644P: Organic Chemistry Special Practical II

[60 Hrs] [2 Credits]

Course Objectives

The main objective of this course is

1. To analyze nitrogen, halogen and sulphur by chemical methods.
2. To estimate some natural products and drugs by spectrophotometric/calorimetric and other instrumental methods.
3. To perform multi-step preparations of some important organic compounds
4. To elucidate structure of organic compounds on the basis of spectral data (UV, IR, 1H and 13CNMR and Mass)

Course Outcomes

By the completion of the above course, students will be able to

1. Estimate nitrogen, halogen and sulphur by chemical methods.
2. Analyse some natural products and drugs by spectrophotometric/calorimetric and other instrumental methods.
3. Demonstrate the multi-step preparations of some important organic compounds
4. Elucidate structure of organic compounds on the basis of spectral data (UV, IR, 1H and 13CNMR and Mass)

Syllabus of M.Sc. II Semester IV ELECTIVE - I

PCH645T: Statistical Thermodynamics, Macromolecules and Phase

[30 Hrs] [2 Credits]

Course Description

The course is designed to cover some important fundamental topics in physical chemistry that will be helpful to students in better understanding of the subject.

Course Objectives

1. To get introduced to fundamentals of Statistical Thermodynamics.
2. To extend the study of Gibbs phase rule to more advanced one, two and three component systems.
3. To understand the concept and methods of determination of molecular mass of macromolecules.

Course Outcomes

The learner will:

1. Correlate the important concepts of statistical thermodynamics and compare Maxwell Boltzmann, Bose Einestein, Fermi Dirac statistics.
2. Apply Gibbs phase rule to study different one-, two- and three component systems.
3. Explain the concept and methods of determination of molecular mass of macromolecules.

ELECTIVE - II

PCH645T: Environmental Chemistry II

[30 Hrs] [2 Credits]

Course Description

The course is designed to make students aware of important types of pollutions – thermal, noise, radioactive and solid waste. Students will learn the sources, harmful effects and preventive measures of these types of pollutions.

Course Objectives
The course is designed with following course objectives -
- To learn about sources, harmful effects and prevention of thermal, noise and radioactive pollution.
- To understand the classification, consequences and management of solid waste pollution.
- To understand synthesis and degradation of plastics.

Course Outcomes
The expected course outcomes are given below:
1. Students will recognize the sources, harmful effects and prevention of thermal, noise and radioactive pollution.
2. Students will classify the solid wastes, assess the impact of toxic chemicals on the metabolism.
3. Students will investigate the photochemical and biological degradation of polymers.

ELECTIVE - III
PCH645T: Medicinal Chemistry II
[30 Hrs] [2 Credits]

Course Description
The course is aimed at making students aware of legal aspects related to medicinal industry. Students will learn the statistical analysis to interpret the data. Students will be introduced to various drug types and their synthesis methods.

Course Objectives
- To learn the legal aspects related to drugs.
- To understand application of statistical methods in quality control of drugs.
- To study briefly role and few examples of antidiabetic agents, anti-viral agents, anti- malarial agents, local anti-infective drug.

Course Outcomes
On successful completion of this course -
1. Students will analyze the implications of drug regulations, including drug rules and acts, and apply statistical methods to assess the effectiveness of antidiabetic agents in various contexts.
2. Students will synthesize and integrate knowledge about antiviral agents, anti-malarial agents, and local anti-infective drugs, demonstrating a comprehensive understanding of their chemical structures, mechanisms of action, and synthesis methods.
3. Students will synthesize knowledge about histamine and antihistaminic agents, antibiotics, and their synthesis methods, demonstrating a deep understanding of their chemical properties and mechanisms of action.

Course outcomes of MSc Mathematics

M.Sc. (Mathematics) Part-I
Semester-I
DSC-1
Algebra

Course Specific Objectives:

1. To develop a sound understanding of algebraic structures, groups, normal groups, ideals, homomorphism and modules.
2. To develop ability in abstract algebraic reasoning using algebraic methods.
3. To develop the skills to analyze and prove algebraic theorems.
4. To acquire effective skills in presenting mathematical proofs, concepts, and ideas of algebra.

Course Learning Outcomes:

1. Student develops a deep understanding of algebraic structures, groups, normal groups, ideals, homomorphism and modules.
2. Gain ability in abstract algebraic reasoning using algebraic methods.
3. Students have the skills to analyze and prove algebraic theorems.
4. Has an effective skill in presenting mathematical proofs, concepts, and ideas of algebra.

DSC-2
Topology

Course Specific Objectives:
1. To study and understand countability, topological spaces, closure, interior, exterior and boundary operators.
2. To acquire a thorough knowledge of advanced topics such as Connectedness, Compactness, Components, Continuous functions, Homeomorphisms, Separability.
3. Develop a deeper appreciation for the fundamental concepts and principles of topology, their applications in various mathematical disciplines, and their connections to other branches of mathematics.
4. To acquire effective skills in presenting mathematical proofs, concepts, and ideas in topology.

Course Learning Outcomes:
1. Students acquire a comprehensive understanding of countability, topological spaces, closure, interior, exterior and boundary operators.
2. Students acquire a thorough knowledge of advanced topics such as Connectedness,
Compactness, Components, Continuous functions, Homeomorphisms, Separability.
3. Learnrs develop a deeper appreciation for the fundamental concepts and principles of topology, their applications in various mathematical disciplines, and their connections to other branches of mathematics.
4. To acquire effective skills in presenting mathematical proofs, concepts, and ideas intopology.

DSC-3
Ordinary Differential Equations

Course Specific Objectives:

1. To study and understand differential equations and their applications in various fields of science, engineering, and mathematics.
2. To acquire a thorough knowledge of advanced topics such as homogeneous and nonhomogeneous differential equations, Wronskian, Legendre and Bessel's equations Solutions to System of first order ordinary differential equations, Sturm Liouville theory.
3. Study and analyze the properties and behaviour of solutions to differential equations, including stability, existence and uniqueness of solutions
4. Apply differential equations to model and solve real-world problems in areas such
as physics, biology, economics, engineering, and other scientific disciplines

Course Learning Outcomes:

1. The learners understand homogeneous and nonhomogeneous differential equations, and special type differential equations
2. Students acquire a thorough knowledge of advanced topics such as Solutions to System of first order ordinary differential equations, and its application to Central forces and planetary motion.
3. Students are able to analyze the properties and behaviour of solutions to differential equations, including stability, existence and uniqueness of solutions
4. They have enhanced problem-solving skills and the ability to think critically and creatively in formulating and solving problems involving differential equations.

DSE-1

Integral Equations

Course Specific Objectives:

1. To study and understand integral equations and integral equations and integro-differential equations
2. To acquire knowledge of Fredholm equations, kernels and Hilbert- Schmidt theorem.
3. Study and analyze the properties and behaviour of solutions to Voltera equations, Fourier integral equations. Laplace integral equations.
4. To study and understand Hilbert transform, Eigen values and Eigen functions.

Course Learning Outcomes:

1. Students understand integral equations and integral equations and integro-differential equations
2. They acquire knowledge of Fredholm equations, kernels and Hilbert- Schmidt theorem.
3. Students study and analyze the properties and behaviour of solutions to Voltera equations, Fourier integral equations. Laplace integral equations.
4. They understand and can apply Hilbert transform, Eigen values and Eigen functions to divorce problems.

Semester-II

DSC-5

Real Analysis

Course Specific Objectives:

1. To build a comprehensive understanding of limits, continuity, differentiation, convergence, vector fields, mappings and manifolds.
2. Acquire proficiency in using mathematical reasoning and proofs to solve complex
problems in analysis
3. To enhance problem-solving skills and creativity in formulating and solving

mathematical problems in analysis.
4. To analyze and prove algebraic theorems and acquire effective skills in presenting mathematical proofs, concepts, and ideas in analysis.

Course Learning Outcomes:

1. Students acquire a comprehensive understanding of limits, continuity, differentiation, convergence, vector fields, mappings and manifolds.
2. Students become proficient in using mathematical reasoning and proofs to solve
complex problems in analysis
3. Has enhanced problem-solving skills and creativity in formulating and solving mathematical problems in analysis.
4. Learners are able to analyze and prove algebraic theorems and acquire effective skills in presenting mathematical proofs, concepts, and ideas in analysis.

Programme Outcomes for Certificate Course

The Certificate Courses at Bajaj College of Science are designed to provide focused, specialized knowledge and practical skills in a specific scientific area, preparing students for immediate application in professional or academic settings.

PO1-Disciplinary Expertise

Graduates will acquire fundamental and applied knowledge in a specific subject area, enabling them to understand key concepts, methodologies, and practices. They will be equipped to apply this knowledge effectively in their chosen field, whether in industry, research, or further education.

PO2-Critical and Analytical Thinking

Graduates will develop the ability to critically assess data, theories, and methodologies within their area of study. They will use analytical thinking to solve basic problems, make informed decisions, and provide reasoned arguments, preparing them for entry-level roles or further study.

Programme Specific Outcomes (PSOs) for Certificate Course

PSO1: Practical Skill Development

Graduates will gain hands-on experience and technical skills relevant to their specific certificate course, enabling them to perform practical tasks and apply techniques with confidence in real-world scenarios, including laboratory settings, industry applications, or fieldwork.

PSO2: Career and Lifelong Learning Orientation

Graduates will be equipped with foundational knowledge and skills that enhance their employability and career prospects. They will also develop a mindset for lifelong learning, staying updated with advancements in their field and pursuing further education or professional certifications as needed.

Department of Botany

"Certificate course on Mushroom Cultivation"

Specification of the course -

A) Nature	Certificate course
B) Credit	2
C) Duration	2 Months (30 hrs.)
D) Number of students to be admitted	20-30
E) Fee proposed	500
F) Eligibility	UG and PG students

1. COURSE OBJECTIVES:

1. Basics and advance knowledge of Mushroom cultivation.
2. Hands on training for mushroom cultivation
3. To provide awareness about marketing trends of mushrooms.

2. EXPECTED COURSE OUTCOMES:

By successfully completing this course, students will be able to:

1. Gain the knowledge about spawn production and cultivation process of Mushrooms.

2. Small scale start-up idea and marketing of mushroom cultivation.

"Certificate course on Statistical Analysis using R"

Specification of the course -

A) Nature	Certificate course
B) Credit	2
C) Duration	2 Months (30 hrs.)
D) Number of students to be admitted	20-30
E) Fee proposed	500
F) Eligibility	UG and PG students

1. COURSE OBJECTIVES:

The course "Statistical Analysis using R" aims to:
Equip participants with fundamental knowledge of R programming for statistical analysis. Provide hands-on experience in data manipulation, visualization, and interpretation using R.
Enable participants to apply statistical techniques in real-world datasets for effective decision-making.

2. EXPECTED COURSE OUTCOMES:

By the end of the course, participants will be able to effectively analyze and interpret data using R, applying various statistical techniques. They will also be proficient in creating visualizations and reporting insights from real-world datasets.

Department of Microbiology

Certificate Courses & Diploma Coursees

Course Objectives and Course Outcomes

1. **Certificate Course in Clinical Laboratory Techniques (CLT)**

Course Objectives:

- To impart crucial job skills to the students
- To opt parallel sub-discipline course while pursuing their degree level education
- To update the knowledge and skills of students in clinical and pathological study.

Course Outcome:

- Students will learn about: 1) Haematology 2) Clinical Pathology (Collection of blood, stool, urine, cerebrospinal fluid, pus, Sickle cell preparation, Osmotic fragility test). Internship of at least 8 days at well recognised Pathology
- Students will learn about Bacteriology (Classification, Cultivation, isolation and identification & Pathogenicity of Medically important bacteria, Preservation of stock cultures. 2) Media (Different methods of sterilization of media and its preparation).

- Students will learn about 1. Elementary knowledge of handling, maintenance & care of analytical instruments (Weighing Balance, Centrifuge, pH Antibodies Antigen Cycler, Electrophoresis).
- Students will learn about 1) Clinical Biochemistry (Proteins, Lipids & Carbohydrates)

2) Human physiology (Structure, location& distribution of different parts of human body)

- Students will learn about 1) Immunology (Antigen, Antibodies Antigen – antibody Reactions and Hypersensitivity)
- Students will learn about different Staining Techniques (Simple staining, Differential staining, Negative staining, spore staining, Capsular staining, Flagellar staining).

2. **Certificate Course in Introduction to Pharma and Biotech Industry, cGMP, Quality Control and Research in Industry**

Course Objectives:

- To develop the understanding among the students regarding need of the pharmaceutical and Biotech industry.
- To inculcate actual application of theoretical knowledge during academic studies in Industry.
- To aware the students about regulations followed in pharmaceutical and Biotech industry process

Course Outcome:

- This course will help students who want to peruse career in Pharmaceutical Industry in various departments like Manufacturing, Research, Quality Operations and Regulations.
- It will develop and strengthen several work-related skills making them competent and confident in handling all the departmental activities within the industry effectively and efficiently.
- It develops the interest of students to work in Industry and take the challenges
- This will prepare the student for entry into industry with interview skill and good communication potential
- This course will be useful as link between academic theoretical knowledge and industry culture
- This course will motivate students to pursue career in Pharmaceutical and biotechnology Industries

3. **Certificate Course in Biofertilizer Production**

Course Objective:

- The objective of the course is to demonstrate the low-cost media preparation
- To impart hands on training on the skills associated with Biofertilizer organisms' isolation, production and application.
- To impart training of ecofriendly agricultural inputs in biofertilizer production.

Course Outcome:

On successful completion of the course, the learners should be able to

- Describe about the importance of biofertilizers.
- Identify bacterial, algal and fungal biofertilizer.
- Assess the quality control of biofertilizers.
- Distinguish the types of biofertilizers.
- Learn methods of application of biofertilizers in field.
- Development of integrated management for best results using nitrogenous and phosphate biofertilizer

Department of Chemistry
Course name Skill based certificate course in Industrial Wastewater Management.

Course Description

This skill-based certificate course focuses on industrial wastewater management, addressing treatment techniques, regulatory compliance, and sustainable reuse practices. It equips learners with hands-on knowledge to design, monitor, and optimize wastewater treatment systems.

Course Objectives

1. To understand the principles and challenges of industrial wastewater management.
2. To learn advanced treatment methods for removing contaminants and achieving regulatory standards.
3. To develop practical skills for designing and implementing sustainable wastewater treatment solutions.

Course Learning Outcomes

1. Analyze the sources and characteristics of industrial wastewater.
2. Apply appropriate treatment techniques for pollutant removal and water reuse.
3. Demonstrate proficiency in designing and operating wastewater treatment systems.
4. Evaluate wastewater management strategies for environmental and regulatory compliance.
5. Develop sustainable solutions to minimize industrial water footprint.

Department of Computer Science
Course Name- Certificate Course in Computer Awareness.
Certificate Course
(Code:)

Computer Awareness

Credits: 2 (2 Th) **No. of Lectures: 30** **No. of Practical: 10**

Course Description:

This course provides the foundational knowledge of the computers to all students.

Learning Objectives:

This course is designed to satisfy the following objectives:

- To learn basic computer concepts and be proficient in handling of computers.
- To make them confident and skilful in performing the computer-based tasks related to their academic and day-to-day work.
- To acquaint and make them familiar with recent trends in the cyber world.

Course Learning Outcomes:

After successful completion of the course student will be able to:

- Understand various fundamental concepts related with handling of computers.
- Perform variety of tasks like document creation, formatting, printing, etc. using MS Word.
- Learn to safely explore the cyberspace and exchange information through mails.

Department of Physics

Certificate Course in
"Astronomy and Indian Space Science"
2024-25

NOTICE

This is to inform that from this following certificate course is going to commence, hence those who are interested may enrol for the same. The details of course are given below.

Details of Certificate Course

Specifications of Course:

A) Nature	- Certificate Course
B) Number of Credits	- 2*
C) Duration	- **30 hrs**
D) No. of Students to be admitted	- **25**
E) Fee Proposed	- **500/-**

I. COURSE OVERVIEW:

This course provides an understanding of basics of Astronomy and Astrophysics. It will also cover the milestones of Indian space program.

II. ELIGIBILITY: UG/PG (Pursuing)

III. COURSE OBJECTIVES:

The objective of the course is to impart knowledge and skills to the learner to:

- Understand universe and its content.
- Aware about Indian space Science program and achievements.

IV. EXPECTED COURSE OUTCOMES:

After completion of this course, the student will be able to demonstrate the knowledge and will have the ability to:

CO1: Recognize universe and its content.
CO2: Describe about history of universe.
CO3: State basic knowledge of our own solar system.
CO4: Explain how stars are formed.
CO5: Recognise about Life cycle of stars.
CO6: Review about astronomical telescopes
CO7: Explain about Indian space Science program and achievements.

Department of Zoology

Certificate Course on

Vermicompost Technology
CC -VCT

Specifications of the course

A) Nature	Certificate course
B) Duration	30 hrs
C) Number of students to be admitted	15 to 20
D) Fee proposed	Rs. 200/-
E) Eligibility	10+2 (Open to all)

I. Brief Proposal:

Earthworms have been on this planet over 20 million years. It is well known that earthworms are nature's way of recycling organic nutrients. From the ancient times, earthworms are used to recycle organic wastes and production of manure. Earthworms are able in converting decomposing food and other organic wastes into nutrient-rich fertilizer which are inexpensive, energy efficient and free of harmful chemicals. In the present time, looking at the growing need of waste management and the need of organic bio fertilizer in agriculture industry, vermicomposting technology is the need of the hour. Vermicomposting can be considered a faster, environment friendly method in recycling of organic waste materials simultaneously producing a superior quality of manure. Vermicomposting is not only useful in recycling of food wastes but can be utilized in recycling cardboard and paper as well as agriculture waste, manures and biosolids which may be an environmental hazard.
Wardha district is one of the agriculture based districts of Maharashtra. Most of the agriculture farms grows cotton as well as other seasonal crops. Presently, the farmers are switching from the conventional chemicals to the organic fertilizer, vermicompost and biofertilizers. Similar trends are also observed in adjoining districts as well as the state of Maharashtra where use of chemical free organic fertilization has taken a giant leap. There are several industry and institutes in Maharashtra who are in the business of making the organic biofertilizers including Vermicompost.
Shiksha Mandal (Parent organization) is dispersing Education in various fields like science, commerce and agriculture from a century. This organization is known for its ethics and Gandhian thoughts. One of our sister institute Rural Institute, Pipri is engaged producing vermicompost for the last 30 years and successfully providing it to the local farmers.
On the basis of guidance with this college and Pune based Industry; supplier of Vermicompost throughout India is the driving force for us to propose this course. Another aspect of this proposal is 90% of students commute from nearby places and are from agricultural background. So this practice will add a source of income to them as well as it is an attempt to reduce dumped waste contribution from houses and gardens.
As Wardha district is the agriculture based district vermicompost is having good demand from the farmers as well as by the homemakers for gardens and kitchen garden.

II. Objective of the course:

I. To develop scientific temperament among the students on vermiculture and vermicompost with special reference to natural production of organic manure.

II. To develop the knowledge of recycling of garbage waste to compost which can be a source of income.
III. To develop and give ideas to students to become entrepreneurs by making vermicompost and selling them.
IV. To make students residing in cities start vermicompost in small scale at houses/society and hostels.
V. To develop skills in students so that they can be job ready for different posts in Biofertilizer industry as Product manager, Marketing manager, Delivery manager, Project associate, Technical manager, Technician, Research associate, trainer, product analyst, processing and packaging manager, etc.

III. Expected Outcome of the Course:

I. This course will lead into production of organic manure.
II. The Kitchen Waste and other garden waste would be used for this compost preparation hence decrease in the dumped garbage waste is expected.
III. Promote students to become entrepreneurs and get jobs as Product manager, Marketing manager, Delivery manager, Project associate, Technical manager, Technician, Research associate, trainer, product analyst, processing and packaging manager, etc. in Biofertilizer industry.

Programme Outcomes for Postgraduate Diploma

The Postgraduate Diploma programme at Bajaj College of Science is aimed at providing advanced, practical knowledge and skills in a specialized scientific domain, preparing students for professional roles or further advanced study.

PO1- Disciplinary Expertise

Graduates will possess in-depth knowledge of advanced concepts, techniques, and tools in their specific field of study. They will be able to apply theoretical and practical insights to complex scientific or professional problems, equipping them for higher-level roles in industry or research.

PO2-Critical and Analytical Thinking

Graduates will demonstrate strong analytical skills, with the ability to critically evaluate scientific literature, assess experimental data, and make informed decisions. They will be adept at problem-solving, synthesizing information from multiple sources, and proposing innovative solutions to discipline-specific challenges.

Programme-Specific Outcomes (PSOs) for Postgraduate Diploma

1. Graduates will acquire specialized knowledge and practical skills in their chosen field, enabling them to design and execute advanced experiments, analyze results, and apply findings to real-world challenges in industry or academia.
2. Graduates will develop proficiency in utilizing modern tools, technologies, and methodologies, fostering innovation and contributing to sustainable solutions in their domain of expertise.

Department of Microbiology

Diploma Course

1. **Post Graduate Diploma in Clinical Research**

Course Objectives:

- To understand the key concepts in the responsible conduct of research
- Able to conduct research that conforms to the highest standards for the protection of human research subjects.
- To impart the knowledge of clinical research and management

Course Outcome:

- This course makes students proficient in clinical data collection and management
- This course increases the understanding of students for clinical trials and drug development
- This course will acquaint students for Pharmacovigilance
- This course will open up a wide scope of employment opportunities for trained professionals.
- This will make students efficient to work in MNC's, pharmaceuticals companies, Clinical Research Associate (CRA), Clinical data management (CDM) Clinical Research Organization (CRO) Clinical Monitor or Trial Monitor, Biostatistician, Drug Safety Associate
- This course will help to start business as a Site Management Organization