PG Science PO PSO_CO

M.Sc. Biochemistry

Goals of M.Sc. Biochemistry Course

- To inculcate scientific temperament and problem-solving skills in the field of Biochemistry among young graduates.
- To train graduates in developing research aptitude and encouraged them to share and resolve their scientific curiosity through scientific methods and critical and rational thinking.
- To train graduates in state of art laboratory skills so as to be able to perform proper experiments in the laboratory, communication skills so as to convey their ideas and innovation, and research skills to develop research aptitude.

Objectives of M.Sc. Biochemistry Course

- To develop the scientific temper, critical thinking and communication skills in thefield of Biochemistry
- To develop basic laboratory skill through individual hands on training.
- To develop understanding of the scientific foundation of Biochemistry and itsapplication in the development of Nation.
- To develop attitudes for innovation and entrepreneurship in the field of Biochemistry.
- To develop disciplined, just and law abiding citizen.

Program Outcomes (POs) for Postgraduates Programme

After completing the post-graduation studies in any subject belonging to science (Physics, Biochemistry and Biotechnology, Chemistry, Computer Science and Law), student will be able to

PO1: Apply the knowledge of the respective domain of knowledge and specialization to the solution of complex problems in professional, social and personal life.

PO2: Develop a multidisciplinary perspective and contribute to the knowledge capital of the world in general and the country in particular.

PO3: Acquire communication and presentation skills and become employable in the job market.

PO4: Develop sensitivity for social issues and become proactive citizens.

PO5: Examine and explain how the subject has influenced the progress in the other areas of science and technology useful in the betterment of life of common people and development of society.

PO6: Acquire high level skills in laboratory experimentation and inferring logical conclusions.

PO7: Participate in Project works, doing independent designing & execution of the research work.

PO8: Recognize the areas which need further research work and could take up an independent research project in a R & D organization or in any industrial organization.

PO9: Demonstrate in-depth knowledge both conceptual and applied pertaining to their core discipline.

PO10: Students become well-equipped to be placed in health care organizations, data science laboratories, environmental organizations, higher educational institutions, food or dairy and beverage industries, and pharmaceutical industries.

Program-Specific Outcomes of M.Sc. Biochemistry

On the completion of M.Sc. Biochemistry students must be able to

PSO1. Possess an advanced level of understanding in the fundamentals of biochemical processes. Exhibit a comprehensive understanding of the major thrust areas within the discipline.

PSO2. Knowhow on current developments in the biochemical research. Capacity to identify, analyze and design safe experimental process, to provide efficient solutions by fair interpretation of data.

PSO3. Gain perfect insight into biochemical research ethics for production of quality research and publication.

PSO4. Possess a lifelong learning mindset to foster personal growth as a successful researcher and establish oneself as a biochemistry entrepreneur.

Course Outcomes of M.Sc. Biochemistry

M.Sc. Biochemistry is 4-semester course conducted by Dr. Ambedkar College, Deekshabhoomi, Nagpur as per the syllabus provided by Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. Each semester students have to take four theory papers, two Practicums based on four theory papers, and a Seminar. The fourth semester has a six-month Research Project Work. Third and Fourth Semester has Two Elective papers. Coursework is according to theory papers, practicums, and seminars conducted throughout the program.

M. Sc. BIOCHEMISTRY

Semester I

Paper 1 (Code: 1T1) Protein Biochemistry

Course outcome Students will be able to:

CO 1: Remember basic protein structure, chemical bonding or molecular geometry based on accepted models and understand the capabilities and limitations of instrumental methods.

CO 2: Conceptualize the process of translation and its regulatory aspects so as to apply the concept for understanding protein structural dynamics with respect to protein functions.

CO 3: Develop competence amongst the students for application of physical parameters in protein functional dynamics depending upon organelle specific environment.

CO 4: Investigate the relationship between protein structure and enzyme function and explore computational methods and algorithms used in protein design.

Paper 2 (Code: 1T2) Advanced Enzymology

Course outcome Students will be able to

CO 1: Remember and understand enzyme kinetics, regulation, and the role of metal ions in enzymatic catalysis. They will be able to analyze and interpret enzyme kinetic data, design experiments to study protein-ligand interactions, and understand the catalytic mechanisms of specific enzymes

CO 2: Gain an in-depth understanding of the mechanisms and regulation of allosteric enzymes, the significance of sigmoidal kinetics, and the different modes of action in allosteric regulation, the applications of immobilized enzymes in industry, and the organization and properties of multienzyme complexes.

CO 3: Have a total comprehension of rate of responses and request of responses, and restraints and their kinetics. To gain information on protein catalysis and isoenzymes and on multienzyme and

multienzyme complexes with specific examples.

CO4: Develop intellectual capacity to relate bioenergetics principles and the entropy to the law of thermodynamics and Free energy and its connection to chemical equilibria in consolation to enzyme catalysis.

Paper 3 (Code: 1T3) Biochemical Research Techniques

Course outcome Students will be able to

CO1: Deduce the probable outcomes of an experiment based on observations following laws of probability and also assess the significance of the interpretation through tests of significance such as t-test.

CO2: Learn the discrepancies and deviations of the variable based on measures of dispersion and Study the relationship between variables based on correlation and regression analysis.

CO3: Evaluate the reliability and credibility of retrieved data, Develop effective scientific writing skills for research papers, reports and Develop effective presentation skills for communicating research findings.

CO4: To remember and understand the importance and applications of computational methods and statistical softwares in Biology.

Paper 4 (Code: 1T4) Plant Biochemistry

Course outcome Students will be able to

CO 1. Remember and comprehend plant cellular architecture and the mechanism of photosynthetic systems for photophosphorylation will enable the students to get a dissected approach for understanding autotrophic food synthesis mechanism driven by photon energy operative in plants.

CO2. Appreciate thorough insight of growth regulatory mechanism of plants through which they will be able to devise the hormonal concoction required for organogenesis and related plant tissue culture applications.

CO3. Learn metabolic attributes and driving principles of plant growth through basic carbohydrate, lipid and protein metabolism. Also the students will be developing a comprehension of importance of nitrogen and sulphur metabolism in plants and associated plant physiological alterations.

CO4. Analyze the biochemical mechanisms underlying plant resistance to biotic stress, including pathogen recognition, signal transduction, and defense molecule synthesis.

PRACTICAL 1 (Code: 1P1) Protein Biochemistry and Enzymology

Course outcome Students will be able to

CO1: Learn laboratory safety protocols and good laboratory practices specific to protein biochemistry and enzymology and the importance of accuracy, precision, adherence to standard operating procedures, and safe handling of proteins and enzymatic reagents.
CO2: Gain hands-on practical experience and will enhance their understanding of protein structure and function, enzymatic reactions, and protein-protein interactions, preparing them for careers in research, biotechnology, or related fields.

PRACTICAL 2 (Code: 1P2) Biochemical Research Techniques and Plant Biochemistry

Course outcome Students will be able to

CO1: Acquire hands-on experience and skills in laboratory techniques and analysis related to biochemical research and plant biochemistry.
CO2: Infer tools and techniques for spectrophotometric and colorimetric analysis of biochemical compounds

M.Sc. BIOCHEMISTRY
SEMESTER – II

Paper – I (Code: 2T1) Immunology

Course outcome Students will be able to

CO1: Comprehend the basic concept of Immunology, Molecular details of various receptors and effectors involved in evoking Immune responses.

CO2: Remember the Mechanism and pathways of immunity with essential details about immunoglobulin structures and mechanism of action.
CO3: Explore the interactions between antigens, MHC molecules, and T cell receptors (TCRs) in the activation of T lymphocytes and the role of MHC in antigen presentation.
CO4: Appreciate and assess the various immunological techniques used for public health. Applications of immunology based techniques in public health and immunization.

Paper – II (Code: 2T2) Clinical Biochemistry

Course outcome Students will be able to

CO1: Remember and Understand fundamental concepts in Clinical Biochemistry and recent automations introduced in it.

CO2: Comprehend basics of Endocrine system and hormones involved for regulation of various biochemical functions of target organs.

CO3: Learn about the clinical presentations, diagnostic methods, and treatment options for conditions such as Addison's disease, pheochromocytoma, disorders of steroid metabolism, and pituitary-related syndromes and evaluate and manage patients with endocrine disorders affecting the adrenal and pituitary glands.

CO4: Illustrate, compare and appreciate functions and biochemical attributes of Liver and implications in Clinical Biochemistry.

Paper – III (Code: 2T3) Cell Biochemistry

Course outcome Students will be able to

CO1: Remember and comprehend about fundamentals of cell division cycle and decision making ability of the cells to proceed for duplication with regulatory aspects.

CO2: Explore key players in signal transduction pathways, mechanisms by which these proteins transmit and amplify signals within the cell.

CO3: Illustrate diverse mechanisms by which eukaryotic cells transmit and process information, contributing to the regulation of various cellular functions and physiological processes.

CO4: Comprehend the basic concept of Cancer Biology and stem cells.

Paper – IV (Code: 2T4) Molecular Biology

Course outcome Students will be able to

CO1: Remember understand the fundamental and concepts of Molecular Biology and the experiments involved in it.

CO2: Relate the concepts of Molecular Biology in the development of Biochemical research

techniques.

CO3: Evaluate prokaryotic and eukaryotic transcription, including the key players involved, promoter regions, initiation, elongation, and termination processes.

CO4: Comprehend the diverse nature of viruses and their implications in human health and disease

PRACTICAL 1 (Code: 2P1) Clinical Biochemistry And Immunology

Course outcome Students will be able to

CO1: Learn techniques for analyzing clinical samples, such as blood or urine, for biochemical parameters and gain skills in sample preparation, use of clinical analyzers, and interpretation of results.

CO2: apply their knowledge and practical skills to interpret clinical biochemistry and immunology results, correlate them with patient symptoms, and make appropriate diagnostic and therapeutic recommendations.

PRACTICAL 2 (Code: 2P2) Cell and Molecular Biology

Course outcome Students will be able to

CO1: Analyze and interpret microscopy images.

CO2: Infer tools and techniques for cell culture, including cell line maintenance, media preparation, and sterile techniques and gain skills in cell counting, cell passaging, and monitoring cell viability using trypan blue exclusion or other staining methods.

M.Sc. BIOCHEMISTRY
SEMESTER – III

Paper – I (Code: 3T1) Advanced Molecular Biology

Course outcome Students will be able to

CO1: Understand the concepts of Eukaryotic Transcription regulation mechanisms with details of enzymes involved eukaryotic transcription process.

CO2: Remember and comprehend post transcriptional and translational modifications and regulatory

aspects of it.

CO3: Describe the expression of genes and the regulatory RNAs involved in it.

CO4: Appreciate epigenetic ways of gene expression regulation**.**

Paper – II (Code: 3T2) Biotechnology

Course outcome Students will be able to

CO1: Remember and Understand fundamental concepts of Genetic Engineering.

CO2: Describe the expression of heterologous genes and the vectors involved in it.

CO3: Appreciate technology involved in industrial products of Protein engineering and fermentation technology. Remember and understand the design and functioning of different types of Bioreactors and downstream processing. Evaluate the application of different types of Bioreactors including immobilization reactor system and its kinetics

CO4: Comprehend tools important in Bioinformatics analysis for simplified application of nucleic acid and protein sequence data.

Paper – III (Code: 3T3 A) Toxicology (Biochemical And Environmental Toxicology)

Course outcome Students will be able to

CO1: Remember and understand key principles of toxicology, including various factors affecting toxicity and toxicity assessment

CO2: Evaluate, analyze disposition of toxicants and factor affecting to disposition of toxicants.

CO3: Critically analyze and interpret non-organ directed toxicity. To study effect of environmental toxicity on human beings.

CO4: Develop an understanding of the genetic toxicology and Developmental Toxicology for scientific research practices and Critical evaluation of relationship between target organ toxicity for Experimental design.

Paper – III (Code: 3T3 B) Nutrition (Nutritional Biochemistry) (Core Elective 1)

Course outcome Students will be able to

CO1: Remember and comprehend key principles of energy expenditure, thermogenic effects. Energy requirements and role of dietary fibers in nutrition.

CO2: Interpret and discuss protein energy malnutrition, disorders of mineral metabolism for scientific research.

CO3: Describe the biochemical techniques that are relevant for the investigation of nutrient metabolism.

CO4: Communicate role of clinical nutrition and food allergies in scientific communication frameworks such as written reports and open discussion.

Paper – IV (Code: 3T4) Bioresearch Techniques I (Subject centric core 1)

Course outcome Students will be able to

CO1: Remember and understand key principles of how flow cytometer work, including data analysis for their applications.

CO2. Improve on skillful process of the animal cell culture techniques and experimental demand of knowledge, including an appreciation of the need for good experimental design and scientific research practices.

CO3. Appreciate intellectual curiosity in DNA and RNA techniques and related fields that extends well beyond the course.

CO4. Develop practical laboratory skills in the field of DNA and RNA techniques.

PRACTICAL 1 (Code: 3P1) Biotechnology and Molecular Biology

Course outcome Students will be able to

CO1: Acquire and gain skills in DNA purification, restriction enzyme digestion, ligation, and transformation of DNA into host organisms.

CO2: Perform laboratory experiments, analyze data, interpret results, and draw meaningful conclusions in the area of biotechnology and molecular biology and prepare them for careers in research, genetic engineering, or related fields.

PRACTICAL 2 (Code: 3P2 A) Biochemical and Environmental Toxicology

Course outcome Students will be able to

CO1: Acquire practical skills and knowledge in the techniques and methods of biochemical and environmental toxicology

CO2: Analyze and interpret the data obtained from practical experiments and gain skills in statistical analysis, data visualization, and drawing conclusions based on the experimental results.

OR

3P2 B) Nutritional Biochemistry

Course outcome Students will be able to

CO1: Learn and acquire laboratory safety protocols and good laboratory practices specific to nutritional biochemistry

CO2: Perform laboratory analyses, interpret results, and critically evaluate nutritional information.

M.Sc. BIOCHEMISTRY
SEMESTER 4

Paper – I (Code: 4T1) Advanced Clinical Biochemistry
Course outcome Students will be able to

CO1: Analyse, evaluate and generate information from a wide variety of sources regarding the key principles of aging and Neurological disorders.

CO2: Analyse the effects of obesity on physiological functions, including gene regulation.

CO3: Critically interpret molecular and metabolic diseases, and develop new knowledge domain about them.

CO4: Develop effective, creative and innovative solutions to current research problems in Reproductive Disease and Reproductive Biochemistry.

Paper – II (Code: 4T2) Advanced Immunology
Course outcome Students will be able to

CO1: Appreciate details of lymph node microanatomy and learn the B and T cells Encounter with antigens and study its development.

CO2: Gain insight into antigen presentation and autophagy on a detailed molecular Level.

CO3: Develop knowledge of the cellular and molecular basis for autoimmune disease and allergies.

CO4: Appraise Basic knowledge of tumor immunology and the development of novel Recombinant antibodies for treatment of cancer and autoimmune disease.

Paper – III (Code: 4T3 A) Toxicology (Clinical Research)
Course outcome Students will be able to

CO1: Learn and evaluate about the concepts of acute and chronic toxicity, including the effects of drugs on animals over short-term and long-term exposure. Explore the methods for assessing toxicity, determining dose-response relationships, and interpreting toxicological data.

CO2: Demonstrate competency in biopharmaceutical clinical trial research designs and Regulatory affairs.

CO3: Demonstrate competencies in evaluating clinical research data and

Communicating results. Manage innovative products through the discovery Processes and into the clinical trial phases.

CO4: Identify and classify different types of trial designs when reading a trial report; Understand the essential of GLP, roles and responsibilities of stakeholders in Clinical trials.

Paper – III (Code: 4T3 B) Nutrition (Applied Nutritional Biochemistry)

Course outcome Students will be

CO1: Remember and comprehend tools for dietary assessment, meal planning, nutrient analysis, and generating personalized nutrition recommendations.

CO2: Capable of using selected biochemical techniques relevant in nutritional Biochemical research

CO3: Critical reading of scientific articles in nutritional biochemistry

CO4: Capable of discussing research questions relevant to nutritional biochemistry

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Paper – IV 4T4: Bioresearch Techniques II (Subject centric core 2)

Course outcome Students will be able to

CO1: Learn, describe and build up knowledge domain regarding the latest and most Advanced Bioresearch techniques available for biochemical research.

CO2: Remember and comprehend principles, experimental procedures, and applications of in-vivo crosslinking techniques.

CO3: Comprehend the concept of biophysical and theoretical methods to analyze biomolecular interactions, characterize macromolecules, and study molecular dynamics in various research and industry settings of data and controls related to research techniques.

CO4: Analyze biomolecular interactions, investigate molecular dynamics, and determine thermodynamic parameters of biomolecular binding.

PRACTICAL 1 (Code: 4P1) Advanced Clinical Biochemistry and Immunology and Toxicology and Nutrition.

Course outcome Students will be able to

CO1: Acquire skills in sample preparation, antibody labeling, detection methods, and data analysis.

CO2: Gain hands-on experience and skills in laboratory techniques and analysis related to clicnical biochemistry and toxicology.

PRACTICAL 2: PROJECT

Course outcome Students will be able to

CO1: Design a research project and submit in a form of thesis, they will present their results of the thesis to an audience of peers and faculty, and be able to defend their results during final evaluation.

CO2: Apply initiative and judgment in planning, problem solving and decision making in practice or future study.