

Panskura Banamali College (Autonomous)

Panskura R.S., Purba Medinipur, 721152

Department of Microbiology

Programme: B.Sc. in Microbiology

Programme Specific Outcomes (PSOs) for B.Sc. Microbiology

Description of the PLOs will be earned by Graduate:

- PSO1 Think critically, identify, analyze the problems and then attempt to design solutions that meet with specified goals. Apply appropriate tools efficiently in learners, and daily activities of academics and communication. Analyze with solutions to environmental issues and commit the problems to sustainable development in the environment. Understand the human in term of bioethics
- PSO2 Function significantly at various problem and situations. Communicate proficiently (written or oral) as a responsible member of modern biotechnologist. Understand the research methods and able to analyze, interpret and derive a real conclusion..
- PSO3 Equipped with practical skills and the ability to apply their theoretical concepts to design, perform experiments, analyze and interpret data and thus develop proficiency in laboratory management.
- PSO4 Develop an aptitude towards research through the internship in various field which promote and infuse professional ethics and code of practice among learners, empowering them to work within team with a multidisciplinary perspective.

Course Specific Outcomes (CSOs) for B.Sc. Microbiology

CC1: Introduction To Microbiology And Microbial Diversity

On the successful completion of the course, students will be able to:

CO1: Gives a brief knowledge of history of microbiology and microbiologists those who came consecutively with their discoveries and contributions in this field.

CO2: Provides an information about how to classify cellular microorganisms based on their general characteristics.

CO3: Establishes a very good understanding of fungi, algae, protozoa in terms of their general characters, reproduction, life cycle, habitat, thallus organization and importance.

CO4: Are able to perform basic microbiological laboratory experiments and tools.

CC2: Bacteriology

On the successful completion of the course, students will be able to:

CO1: Gives a brief knowledge of cellular organization of bacteria.

CO2: Develop skills on bacteriological techniques which includes pure culture isolation, cultivation, culture preservation.

CO3: Are able to visualize microbial cells under microscopes.

CO4: Provides information about pattern of growth, nutritional mode, taxonomy and some important archaeal and eubacterial bacterial groups.

CC3: Biochemistry

On the successful completion of the course, students will be able to:

CO1: Developed a very good understanding of various biomolecules which are required for development and functioning of a bacterial cell.

CO2: Developed how the carbohydrates make the structural and functional components such as energy generation and as storage food molecules for the bacterial cells

CO3: Well understood about multifarious function of proteins; are able to calculate enzyme activity and other quantitative and qualitative parameters of enzyme kinetics; also knowledge about lipids and nucleic acids.

CO4: Student are able to make buffers, study enzyme kinetics and calculate V_{max} , K_m , K_{cat} values.

CC4: Virology

On the successful completion of the course, students will be able to:

CO1: Described viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria (bacteriophages)

CO2: Understanding about the biology of bacteriophages.

CO3: Gained knowledge of a variety of plant viruses and animal viruses.

CO4: The ability to describe role of viruses in the causation of the cancer'

CC5: Microbial Physiology and Metabolism

On the successful completion of the course, students will be able to:

CO1: Describing the growth characteristics of the microorganisms capable of growing under unusual environmental condition of temperature, oxygen, and solute and water activity.

CO2: Explained the growth characteristics of the microorganisms which require different nutrient for growth and the associated mechanisms of energy generation for their survival like autotrophs, heterotrophs, chemolithoautotrophs etc.

CO3: Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms.

CC6: Cell Biology

On the successful completion of the course, students will be able to:

CO1: Able to distinguish prokaryotic and eukaryotic cells in terms of their structures and internal organization.

CO2: Understood the structures of nucleus.

CO3: Described the roles of ribosomes, endoplasmic reticulum, golgi apparatus, lysosomes in protein targeting, folding, processing, sorting and transporting.

CO4: Able to understand cell signaling very well.

CC7: Molecular Biology

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good understanding of salient features of genetic elements and DNA topology.

CO2: Discussed a fundamental concept of central dogma.

CO3: Able to understand the regulation of gene expression in prokaryotes and eukaryotes.

CO4: Able to perform all experiments of Molecular biology.

CC8: Microbial Genetics

On the successful completion of the course, students will be able to:

CO1: Described genome organization of model organisms namely E.coli and Saccharomyces, and the molecular mechanisms that underlie mutations.

CO2: Developed a fairly good knowledge about the three well known mechanisms by which genetic material is transferred among the microorganisms namely transformation, transduction and conjugation.

CO3: Are able to describe different types of the extrachromosomal elements or the plasmids; the nature of the transposable elements in the prokaryotic and the eukaryotic cells.

CO4: Hands on skills of isolation of plasmid DNA from bacterial cells and its visualization by performing agarose gel electrophoresis.

CC9: Environmental Microbiology

On the successful completion of the course, students will be able to:

CO1: Have developed a fairly good knowledge and understanding of different types of environments and habitats where microorganisms grow including the microbiomes of the human gut and animal gut.

CO2: Are able to identify the important role microorganisms play in maintaining healthy environment by degradation of solid/liquid wastes; how these activities of microorganisms are used in sewage treatment plants, production of activated sludge and functioning of septic tanks

CO3: Understood the significance of BOD/COD and various tests involving use of enumerating fecal E.coli for assessing quality of water.

CO4: Have developed the practical skills for conducting experiments to assess the BOD/COD of wastewaters and their interpretation; practically assess the portability of drinking water by the use of standard microbiological tests.

CC10: Food and Dairy Microbiology

On the successful completion of the course, students will be able to:

CO1: Developed a clear understanding of effect of intrinsic and extrinsic parameter on the microbial growth.

CO2: Are able to describe the role of microorganisms in the production of food, its spoilage, including their role in homemade fermented foods.

CO3: Are able to identify the role of microorganisms in the causation of the diseases and how to protect against food-borne pathogens.

CO4: Developed experimental skills for testing the milk and different foods for the presence of Microorganisms

CC11: Industrial Microbiology

On the successful completion of the course, students will be able to:

CO1: Are capable of describing a large number of substrate that are used for the industrial fermentation processes.

CO2: Have developed an understanding of different types of reactors or fermenters which are used for laboratory, pilot and industrial scale fermentations and their processes parameters.

CO3: Have acquired a detailed knowledge of number of products which are produced by industrial fermentation processes.

C-12: Immunology

On the successful completion of the course, students will be able to:

CO1: Understood the basic and general concepts of causation of disease by the pathogenic microorganisms and the various parameters of assessment of their severity including the broad categorization of the methods of diagnosis.

CO2: Developed a thorough understanding of common bacterial, viral, fungal, parasitic diseases of human being including some very important diseases of the animals also.

CO3: Conceptualized the protective role of the immune system of the host and developed an understanding of the basic components as well as the mechanisms underlying the immune system and its response to pathogenic microorganisms.

C-14: Recombinant Dna Technology

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good knowledge of the tools and the methods for genetic engineering.

CO2: Has acquired a fairly good understanding of how these tools and methods are employed in the laboratory for manipulation of DNA so as to make it relevant for biotechnological uses.

CO3: Students can perform isolation of DNA, amplification of any gene by PCR and its analysis by gel electrophoresis.

DSE-1: Bioinformatics

On the successful completion of the course, students will be able to:

CO1: Developed skills to use computers for analysis of biological data.

CO2: Skill to use important biological databases, use tools to retrieve data, and compare the data of the biological macromolecules

CO3: Developed basic skills for data retrieval, representation, analysis and interpretation.

DSE-2: Microbial Biotechnology

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good knowledge of the tools and the methods for genetic engineering.

CO2: Has acquired a fairly good understanding of how these tools and methods are employed in the laboratory for manipulation of DNA so as to make it relevant for biotechnological uses.

CO3: Students can perform

DSE-3: Advances In Microbiology

On the successful completion of the course, students will be able to:

CO1: Can explain salient characteristics of genomes of representative microorganisms.

CO2: Have understood the concept and importance of metagenomics.

CO3: Have developed an initial understanding of recent developments of host-microbe interactions, synthetic biology, viable but non-culturable forms of microorganism etc.

DSE-4: Plantpathology

On the successful completion of the course, students will be able to:

CO1: Developed basic concepts of causation of diseases in plants by the different types of microorganisms namely bacterial, fungal and viral.

CO2: Knowledge of important plant diseases, their etiology, salient characteristics and control measures

CO3: Developed skills to analyze the diseased plant samples in the laboratory and are able to identify the salient features of the disease-causing microbe and the lesions produced on the plant parts.

DSE-5: Biomathematics And Biostatistics (Practical)

On the successful completion of the course, students will be able to:

CO1: Have developed basic knowledge of mathematics as applied to biological phenomenon.

CO2: Skill to use important biological databases, use tools to retrieve data, and compare the data of the biological macromolecules

CO3: Developed basic skills for data retrieval, representation, analysis and interpretation.

DSE-6: Inheritance Biology

On the successful completion of the course, students will be able to:

CO1: Good understanding of concepts of Mendelian genetics and structural organizations of chromosomes.

CO2: Developed practical skills to do karyotyping and pedigree analysis.

DSE-7: Microbes In Sustainable Agriculture And Development

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good understanding of microbes in the soil.

CO2: Has developed a fairly good understanding of the use of microbes in sustainable agriculture namely role in biogeochemical recycling, nitrogen fixing, organic matter degradation, use as bio fertilizers, as bio pesticides, production of biofuels

CO3: Has developed skills for growing microorganisms in the laboratory for the production of different enzymes by different microorganisms.

DSE-8: Biosafety And Intellectual Property Rights

On the successful completion of the course, students will be able to:

CO1: Full knowledge of working in a microbiology laboratory taking all safety measures, handling of live bacteria, disposal of infectious waste, care of the equipment requiring safety audit

CO2: Developed knowledge of basic concepts related to IPR.

CO3: Developed knowledge of patent filing, and some well-known/wellpublicized case studies related to IPR

DSE-9: Instrumentation And Biotechniques

On the successful completion of the course, students will be able to:

CO1: Developed understanding of principals, and applications of different microscopic and spectrophotometric methods.

CO2: Developed understanding of principals, and applications of different separation techniques especially chromatographic, electrophoretic and centrifugation techniques.

CO3: Skills in handling and use of light microscope, spectrophotometer and centrifugation equipment to study/analyze various microbiological samples.

GE-1: Introduction And Scope Of Microbiology

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good understanding of the Diversity of the microbes

CO2: Has acquired a fairly good understanding of the activities/importance of microbes.

CO3: Has acquired practical skills of handling microorganisms in the laboratory for study.

GE-2: Bacteriology And Virology

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good understanding of the different types of bacteria and viruses.

CO2: Has acquired a fairly good understanding of the structure and other salient characteristics of bacteria and viruses.

CO3: Has acquired skills of visualizing bacteria by staining, using a microscope and culturing bacteria in microbiological media to describe the features of bacterial colonies.

GE-3: Microbial Metabolism

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good understanding of normal microflora of human body, common diseases caused by bacteria, viruses and other microbes.

CO2: Understood the basic components of the immune system and how this system serve to protect the host against disease-causing microbes.

CO3: Has acquired skills of handling microorganisms in the laboratory and study their characteristics.

GE-4: Industrial And Food Microbiology

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good knowledge of how microbes are used in the fermentative production of organic acids, alcohols, enzymes, antibiotics and various foods in the industry.

CO2: Has acquired knowledge of various physical parameters which affect production of industrial products by the microorganisms and the safety aspects of the production and use of these products.

CO3: Has developed laboratory skills in producing alcohol and enzymes by fermentative process using bacteria/yeast; Laboratory skills of testing microbial load in milk.

GE-5: Microbes In Environment

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good understanding of microbes in the soil.

CO2: Has developed a fairly good understanding of the use of microbes in sustainable agriculture namely role in biogeochemical recycling, nitrogen fixing, organic matter degradation, use as bio fertilizers, as bio pesticides, production of biofuels

CO3 .Has developed skills for growing microorganisms in the laboratory for the production of different enzymes by different microorganisms.

GE-6: Medical Microbiology And Immunology

On the successful completion of the course, students will be able to:

CO1: Have acquired knowledge how microbes serve as a source for a large number of enzymes

CO2: How these enzymes are produced in the laboratory, how their production is increased by different conditions and how the enzymes are purified.

CO3: Practical skill for production and purification of enzymes; factors affecting microbial enzyme production; immobilization of enzymes.

GE-7: Genetic Engineering And Biotechnology

On the successful completion of the course, students will be able to:

CO1: Has acquired knowledge of gene, their expression and regulation of expression.

CO2: Has acquired a fairly good understanding mechanisms of genetic exchange, mutations and their implications.

CO3: Has developed practical skill for isolation of bacteria/plasmid DNA and its visualization in gel after separation by electrophoresis.

GE-8: Microbial Genetics And Molecular Biology

On the successful completion of the course, students will be able to:

CO1: Has acquired a fairly good knowledge of the tools and the methods for genetic engineering.

CO2: Has acquired a fairly good understanding of how these tools and methods are employed in the laboratory for manipulation of DNA so as to make it relevant for biotechnological uses.

CO3: Students can perform isolation of DNA, amplification of any gene by PCR and its analysis by gel electrophoresis.

SE-1: Microbial Quality Control in Food and Pharmaceutical Industries

On the successful completion of the course, students will be able to:

CO1: Have developed a very good understanding of practical aspects of microbiological safety, various detection methodologies and use of different microbiological media in food industries.

CO2: Have developed a very good understanding of practical aspects of microbiological safety, various detection methodologies and toxicological testing of products in the

SE-2: Microbial Diagnosis In Health Clinics

On the successful completion of the course, students will be able to:

CO1: Have developed a very good understanding of practical aspects of collection of different clinical samples, their transport, culture and examination by staining, and molecular and immunological diagnostic methods for diagnosis of microbial diseases.

CO2: Have developed a very good understanding of practical aspects of antibiotic sensitivity testing, water and food testing skills

SE-3: Biofertilizers And Biopesticides

On the successful completion of the course, students will be able to:

CO1: Have developed a very good understanding of practical aspects of production of biofertilizers.

CO2: Have developed a very good understanding of practical aspects of the production of biopesticides/bioinsecticides.

SE-4: Food Fermentation Techniques

On the successful completion of the course, students will be able to:

CO1: Have developed a very good understanding of practical aspects commercially produced food and fermentative products.

CO2: Have developed a very good understanding of practical use of microbiology for better production of home based food and fermentation products for day to day use

SE-5: Management Of Human Microbial Diseases

On the successful completion of the course, students will be able to:

CO1: Have developed a very good understanding of practical aspects diagnosis of common human infections.

CO2: Have developed a very good understanding of preventive measures for human infections by the use of antibiotics and vaccines.

SE-6: Microbiological Analysis Of Air And Water

On the successful completion of the course, students will be able to:

CO1: Developed a clear understanding of effect of intrinsic and extrinsic parameter on the microbial growth.

CO2: Are able to describe the role of microorganisms in the production of food, its spoilage, including their role in homemade fermented foods.

CO3: Are able to identify the role of microorganisms in the causation of the diseases and how to protect against food-borne pathogens.

CO4: Developed experimental skills for testing the milk and different foods for the presence of microorganisms