

RANIGANJ GIRLS' COLLEGE

DEPARTMENT OF MICROBIOLOGY

Programme Outcomes of B.Sc. Honours in Microbiology

A candidate who is conferred a graduate degree i.e. B.Sc. Honours in Microbiology needs to have acquired and developed the following competencies during the programme of the study:

1. Acquired knowledge and understanding of the microbiology concepts as applicable to diverse areas such as medical, industrial, environment, genetics, agriculture, food and others.
2. Demonstrate key practical skills/competencies in working with microbes for study and use in the laboratory as well as outside, including the use of good microbiological practices.
3. Competent enough to use microbiology knowledge and skills to analyze problems involving microbes, articulate these with peers/ team members/ other stake holders, and undertake remedial measures/ studies etc.
4. Developed a broader perspective of the discipline of Microbiology to enable him to identify challenging societal problems and plan his professional career to develop innovative solutions for such problems.

Programme Specific Outcomes (PSOs) of B.Sc. Honours in Microbiology

- By the end of this course, the students will be able to:
- Understand the contributions of different scientists in Microbiology and the scope of various branches of Microbiology
- Understand various kinds of prokaryotic & eukaryotic microbes and their interactions
- Explain and describe importance of organic compounds and its chemistry found in living cells
- Understand and explain various processes of metabolism of carbohydrates, amino acids and vitamins
- Explain DNA, RNA and protein structure and their synthesis
- Understand the concept of disease development, spread, control and eradication from society
- Understand the basic concepts of gene and their regulation of action
- Explain and write various industrial fermentations and bio-instrumentation.

BSc Honours in Microbiology

Course Outcomes

Semester	Course Name	Course Code	Course Type & Course Details	Course Outcome
I	Introduction to Microbiology & Microbial Diversity	BSCHMCBC101	CC-1	<p>Outcome 1. Have developed a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in this field.</p> <p>Outcome 2. Have developed a very good understanding of the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory.</p> <p>Outcome 3. Are able to explain the useful and harmful activities of the microorganisms.</p> <p>Outcome 4. Are able to perform basic experiments to grow and study microorganisms in the laboratory.</p>
	Bacteriology	BSCHMCBC102	CC-2	<p>Outcome 1. Describe characteristics of bacterial cells, cell organelles, cell wall composition and various appendages like capsules, flagella orpili.</p> <p>Outcome 2. Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups.</p>

				<p>Outcome 3. Describe the nutritional requirements of bacteria for growth; developed knowledge and understanding that besides common bacteria there are several other microbes which grow under extreme environments.</p> <p>Outcome 4. Perform basic laboratory experiments to study microorganisms; methods to preserve bacteria in the laboratory; calculate generation time of growing bacteria.</p>
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Semester	Course Name	Course Code	Course Type & Course Details	Course Outcome
II	Biochemistry	BSCHMCBC201	CC-3	<p>Outcome 1. Developed a very good understanding of various biomolecules which are required for development and functioning of a bacterial cell.</p> <p>Outcome 2. Have developed how the carbohydrates make the structural and functional components such as energy generation and as storage food molecules for the bacterial cells</p> <p>Outcome 3. Well conversant about multifarious function of proteins; are able to calculate enzyme activity and other quantitative and</p>

				<p>qualitative parameters of enzyme kinetics; also knowledge about lipids and nucleic acids.</p> <p>Outcome 4. Student are able to make buffers, study enzyme kinetics and calculate Vmax, Km Values</p>
	Biophysics & Virology	BSCHMCBC202	CC-4	<p>Outcome 1. Understood what are viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria (bacteriophages)</p> <p>Outcome 2. Understanding about the biology of bacteriophages.</p> <p>Outcome 3. Gained knowledge of a variety of plant viruses and animal viruses.</p> <p>Outcome 4. Understand the basic physical parameters of cells or biological processes and basic methods used to study these.</p>

Semester	Course Name	Course Code	Course Type & Course Details	Course Outcome
III	Microbial Physiology & Metabolism	BSCHMCBC301	CC-5	Outcome 1. Describing the growth characteristics of the microorganisms capable of growing under unusual environmental condition of temperature, oxygen, and solute and water activity.

				<p>Outcome 2. Describing 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.</p> <p>Outcome 3. Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms.</p>
Cell Biology	BSCHMCBC302	CC-6	<p>Outcome 1. Recall the history of cytology and draw the structure of cell organelles and locate its parts along with functions.</p> <p>Outcome 2. Distinguish the structure of prokaryotic and eukaryotic cell.</p> <p>Outcome 3. Explain the organization of Genes and chromosomes, chromosome morphology and its aberrations.</p> <p>Outcome 4. Explain the communications of cells with other cells and to the environment.</p>	
Molecular Biology	BSCHMCBC303	CC-7	<p>Outcome 1. Has acquired knowledge of gene, their expression and regulation of expression.</p> <p>Outcome 2. Has acquired a fairly good understanding of the mechanisms of genetic exchange,</p>	

				<p>mutations and their implications.</p> <p>Outcome 3. Has developed practical skill for isolation of bacteria/plasmid DNA and its visualization in gel after separation by electrophoresis.</p>
	Microbial Quality Control in Food and Pharmaceutical Industries	BSCHMCBSEC301	SEC-1	<p>Outcome 1. Have developed a very good understanding of practical aspects of microbiological safety, various detection methodologies and use of different microbiological media in food industries.</p> <p>Outcome 2. Have developed a very good understanding of practical aspects of microbiological safety, various detection methodologies and toxicological testing of products in the pharmaceutical industries.</p>
	Microbial Diagnosis in Health Clinics	BSCHMCBSEC302		<p>Outcome 1. 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.</p> <p>Outcome 2. Have developed a very good understanding of practical aspects of antibiotic sensitivity testing, water and food testing skills using kits available in the market.</p>

Semester	Course Name	Course Code	Course Type & Course Details	Course Outcome
IV	Environmental Microbiology	BSCHMCBC401	CC-8	<p>Outcome 1. 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.</p> <p>Outcome 2. 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</p> <p>Outcome 3. Have understood the significance of BOD/COD and various tests involving use of enumerating fecal <i>E.coli</i> for assessing quality of water.</p> <p>Outcome 4. 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</p>

				microbiological tests.
	Food & Dairy Microbiology	BSCHMCBC402	CC-9	<p>Outcome 1. Are able to describe the role of microorganisms in the production of food, its spoilage, including their role in homemade fermented foods.</p> <p>Outcome 2. Are able to identify the role of microorganisms in the causation of the diseases and how to protect against food-borne pathogens.</p> <p>Outcome 3. Developed experimental skills for testing the milk and different foods for the presence of microorganisms</p>
	Industrial Microbiology	BSCHMCBC403	CC-10	<p>Outcome 1. Are capable of describing a large number of substrate that is used for the industrial fermentation processes.</p> <p>Outcome 2. 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.</p> <p>Outcome 3. Have acquired a detailed knowledge of number of products which are produced by industrial fermentation processes</p>

	Food Fermentation Techniques	BSCHMCBSEC401	SEC-2	<p>Outcome 1. Have developed a very good understanding of practical aspects commercially produced food and fermentative products.</p> <p>Outcome 2. 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</p>
	Bio Fertilizers and Bio Pesticides	BSCHMCBSEC402		<p>Outcome 1. Have developed a very good understanding of practical aspects of production of bio fertilizers.</p> <p>Outcome 2. Have developed a very good understanding of practical aspects of the production of bio pesticides/bio insecticides.</p>

Semester	Course Name	Course Code	Course Type & Course Details	Course Outcome
V	Immunology	BSCHMCBC501	CC-11	<p>Outcome 1. Has acquired a fairly good understanding of normal microflora of human body, common diseases caused by bacteria, viruses and other microbes.</p> <p>Outcome 2. Understood the basic components of the immune system and how this system serves to protect the host against disease-causing microbes.</p>

				<p>Outcome 3. Are able to conduct experiments for growing common bacteria in different microbiological media, antibiotic sensitivity determination and antigen antibody reaction (precipitation test in the agarose)</p>
Medical Microbiology	BSCHMCBC502	CC-12	<p>Outcome 1. Has acquired skills of handling microorganisms in the laboratory and study their characteristics.</p> <p>Outcome 2. 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.</p> <p>Outcome 3. Developed a thorough understanding of common bacterial, viral, fungal, parasitic diseases of human being including some very important diseases of the animals also.</p> <p>Outcome 4. 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.</p>	

	Bio Statistics and Bio Informatics	BSCHMCBDSE501		<p>Outcome 1. Have developed basic concepts of statistics and their importance</p> <p>Outcome 2. Developed skills to use computers for analysis of biological data.</p> <p>Outcome 3. Skill to use important biological databases, use tools to retrieve data, and compare the data of the biological macromolecules</p> <p>Outcome 4. Developed basic skills for data retrieval, representation, analysis and interpretation</p>
	Advances in Virology	BSCHMCBDSE502	DSE-1 and DSE-2	<p>Outcome 1 This advanced virology subject will allow students to further investigate the biology and pathogenesis of medically important viruses at the cellular and molecular level.</p> <p>Outcome 2. The subject will also study how viruses can be used in the biotechnology industry and gene based therapeutic approaches to treat disease.</p> <p>Outcome 3. The subject will also focus on the technology used in the modern diagnostic virology laboratory and recent advances in pathogen detection and disease epidemiology.</p> <p>Outcome 4. The subject will also study viruses from a public health perspective including preventing transmission and</p>

				control of disease outbreaks, including vaccination and pharmacological intervention strategies.
	Advances in Microbiology	BSCHMCBDSE503		<p>Outcome 1. Can explain salient characteristics of genomes of representative microorganisms.</p> <p>Outcome 2. Have understood the concept and importance of metagenomics.</p> <p>Outcome 3. Have developed an initial understanding of recent developments of host-microbe interactions, synthetic biology, viable but non-culturable forms of microorganism etc.</p> <p>Outcome 4. Are able to extract DNA from bacteria / soil and perform PCR for 16s Ribosomal genes using universal primers and interpret the results.</p>

Semester	Course Name	Course Type	Course Code	Course Details	Course Outcome
VI	Microbial Genetics	CC	BSCHMCBC601	CC-13	<p>Outcome 1. Understood genome organization of model organisms namely <i>E.coli</i> and <i>Saccharomyces</i>, and the molecular mechanisms that underlie mutations.</p> <p>Outcome 2. Developed a fairly good knowledge about the three well</p>

				<p>known mechanisms by which genetic material is transferred among the microorganisms namely transformation, transduction and conjugation.</p> <p>Outcome 3. 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.</p> <p>Outcome 4. Hands on skills of isolation of plasmid DNA from bacterial cells and its visualization by performing agarose gel electrophoresis.</p>
Recombinant DNA Technology	CC	BSCHMCBC602	CC-14	<p>Outcome 1. Outline the fundamental steps in a genetic engineering procedure</p> <p>Outcome 2. Describe the mechanism of action and the use of restriction enzymes in biotechnology research and recombinant protein production</p> <p>Outcome 3. Discuss techniques used to probe DNA for specific genes of interest</p> <p>Outcome 4. Explain the steps of a bacterial transformation and various selection</p>

					<p>processes for identifying transformants</p> <p>Outcome 5. Explain the usefulness of plasmid preparations, how they are performed, and how the concentration and purity of plasmid samples can be determined</p>
Inheritance Biology	DSE	BSCHMCBDSE601		DSE-3 and DSE-4	<p>Outcome 1. Good understanding of concepts of Mendelian genetics and structural organizations of chromosomes.</p> <p>Outcome 2. Developed practical skills to do karyotyping and pedigree analysis</p>
Microbial Biotechnology	DSE	BSCHMCBDSE602			<p>Outcome 1. Developed an understanding how microbiology is relevant to technological developments for agriculture and environment.</p> <p>Outcome 2. Developed an understanding how microbiology is relevant to technological developments for industries related to food and fermentations.</p> <p>Outcome 3. Developed an understanding how developments in recombinant DNA technology is juxtaposed with microbially-based technological</p>

				developments for agriculture, industry and environment.
	Plant Pathology	DSE	BSCHMCBDSE603	<p>Outcome 1. Developed basic concepts of causation of diseases in plants by the different types of microorganisms namely bacterial, fungal and viral.</p> <p>Outcome 2. Knowledge of important plant diseases, their etiology, salient characteristics and control measures</p> <p>Outcome 3. 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.</p>

COURSE OUTCOME OF GENERIC ELECTIVE (GE) COURSES

Semester	Course Name	Course Code	Course Type & Course Details	Course Outcome
I	Introduction to Microbiology & Microbial Diversity	BSCHMCBGE101	GE-1	Outcome 1. Have developed a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in

				<p>this field.</p> <p>Outcome 2. Have developed a very good understanding of the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory.</p> <p>Outcome 3. Are able to explain the useful and harmful activities of the microorganisms.</p> <p>Outcome 4. Are able to perform basic experiments to grow and study microorganisms in the laboratory.</p>
II	Biophysics and Virology	BSCHMCBGE201	GE-2	<p>Outcome 1. Understood what are viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria (bacteriophages)</p> <p>Outcome 2. Understanding about the biology of bacteriophages.</p> <p>Outcome 3. Gained knowledge of a variety of plant viruses and animal viruses.</p> <p>Outcome 4. Understand the basic physical parameters of cells or biological processes and basic methods used to</p>

				study these.
III	Microbial Metabolism	BSCHMCBGE301	GE-3	Outcome 1. Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms.
IV	Industrial and Food Microbiology	BSCHMCBGE401	GE-4	<p>Outcome 1. 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.</p> <p>Outcome 2. 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.</p> <p>Outcome 3. Has developed laboratory skills in producing alcohol and enzymes by fermentative process using bacteria/yeast; Laboratory skills of testing microbial load in milk.</p>