

**RANIGANJ GIRLS' COLLEGE
DEPARTMENT OF MICROBIOLOGY**

**COURSE LEARNING OUTCOMES
LEARNING OUTCOME BASED CURRICULUM
FRAMEWORK (LOCF)
UNDER THE
CHOICE BASED CREDIT SYSTEM (CBCS)
OF
KAZI NAZRUL UNIVERSITY**

Course Summary

Semester	Course Name	Course Type	Course Code	Course Details	Page No.	
I	Microbial World and Principles of Microbiology	C	BSCHMCBC101	CC-1	3	
	Bacteriology and Systematics		BSCHMCBC102	CC-2	4	
	Generic Elective Courses	GE		GEC-1		
	Environmental Studies	AE	AEE101	AECC-1		
II	Basic Biochemistry	C	BSCHMCBC201	CC-3	9	
	Microbial Techniques and Instruments		BSCHMCBC202	CC-4	11	
	Generic Elective Courses	GE		GEC-2		
	English/MIL Communication	AE	See Pool	AECC-2		
III	Virology	C	BSCHMCBC301	CC-5	15	
	Microbial Physiology and Metabolism		BSCHMCBC302	CC-6	16	
	Cell and Molecular Biology		BSCHMCBC303	CC-7	18	
	Generic Elective Courses	GE		GEC-3		
	Microbial Quality Control in Food & Pharmaceutical Industries	(Any One)	SE	BSCHMCBSE301	SEC-1	20
	Microbial Diagnostics and Public Health			BSCHMCBSE302		21
IV	Microbial Genetics	C	BSCHMCBC401	CC-8	24	
	Environmental Microbiology and Microbial Ecology		BSCHMCBC402	CC-9	26	
	Industrial Microbiology		BSCHMCBC403	CC-10	27	
	Generic Elective Courses	GE		GEC-4		
	Food Fermentation Techniques	(Any One)	SE	BSCHMCBSE401	SEC-2	29
	Microbial Products			BSCHMCBSE402		30
V	Medical & Veterinary Microbiology and Immunology	C	BSCHMCBC501	CC-11	33	
	Agriculture, Food and Dairy Microbiology		BSCHMCBC502	CC-12	35	
	Biophysics, Biomathematics & Biostatistics	(Any Two)	DSE	BSCHMCBDSE501	DSEC-1 & DSEC-2	36
	Heredity and Evolution			BSCHMCBDSE502		37
	Microbial Biotechnology			BSCHMCBDSE503		39
VI	Advanced Microbiology	C	BSCHMCBC601	CC-13	41	
	Recombinant DNA Technology		BSCHMCBC602	CC-14	42	
	Project Work on Microbiology of Societal Importance	(Any Two)	DSE	BSCHMCBDSE601	DSEC-3 & DSEC-4	44
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	Mycology and Phycology			BSCHMCBDSE603		46

Pool of Generic Elective Courses offered by Microbiology for other Disciplines					
Semester	Course Name	Course Type	Course Code	Course Details	Page No.
I	Microbial World and Diversity	GE	BSCHMCBGE101	GEC-1	6
II	Bacteriology and Virology		BSCHMCBGE201	GEC-2	12
III	Industrial and Food Microbiology		BSCHMCBGE301	GEC-3	22
IV	Genetic Engineering and Biotechnology		BSCHMCBGE401	GEC-4	31

Abbreviations: C= Core; CC=Core Course; AE= Ability Enhancement; AECC= Ability Enhancement Compulsory Course; GE= Generic Elective; GEC= Generic Elective Course; SE= Skill Enhancement; SEC= Skill Enhancement Course; DSE= Discipline Specific Elective; DSEC= Discipline Specific Elective Course; CA= Continuous Assessment, ESE= End Semester Examination, L= Lecture Hour; T= Tutorial Hour and P= Practical Hour/ Field Work and NA= Not Applicable

**BSC HONOURS IN MICROBIOLOGY
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK**

Semester-I

**Course Name: Microbial World and Principles of Microbiology
Course Code: BSCHMCBC101**

Course Type: C	Course Details: CC-1		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: After the completion of this course, the students will –

1. Develop a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in this field.
2. Develop 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.
3. Able to explain the useful and harmful activities of the microorganisms.
4. Able to perform basic experiments to grow and study microorganisms in the laboratory.

**Course Name: Bacteriology and Systematics
Course Code: BSCHMCBC102**

Course Type: C	Course Details: CC-2		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: At the completion of this course, the students will be able to –

1. Describe characteristics of bacterial cells, cell organelles, cell wall composition and various appendages like capsules, flagella or pili.
2. Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups.
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.
4. Perform basic laboratory experiments to study microorganisms; methods to preserve bacteria in the laboratory; calculate generation time of growing bacteria.

Course Name: Microbial World and Diversity
Course Code: BSCHMCBGE101

Course Type: GE	Course Details: GEC-1		L-T-P: 4-0-4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students will -*

- 1. Acquire a fairly good understanding of the Diversity of the microbes*
- 2. Acquire a fairly good understanding of the activities/ importance of microbes.*
- 3. Acquire practical skills of handling microorganisms in the laboratory for study.*

Semester-II

Course Name: Basic Biochemistry
Course Code: BSCHMCBC201

Course Type: C	Course Details: CC-3		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the end of this course the students will -*

- 1. Develop a very good understanding of various biomolecules which are required for development and functioning of a bacterial cell.*
- 2. Understand how the carbohydrates make the structural and functional components such as energy generation and as storage food molecules for the bacterial cells*
- 3. Conversant 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.*
- 4. Able to make buffers, study enzyme kinetics and calculate V_{max} , K_m , K_{cat} values.*

Course Name: Microbial Techniques and Instruments
Course Code: BSCHMCBC202

Course Type: C	Course Details: CC-4		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the end of this course the students will -*

- 1. Understand principles which underlies sterilization of culture media, glassware and plastic ware to be used for microbiological work.*
- 2. Understand principles of a number of analytical instruments which the students have to use during the study and also later as microbiologists for performing various laboratory manipulations.*
- 3. Learned handling and use of microscopes for the study of microorganisms which are among the basics skills expected from a practicing microbiologist. They also get introduced a variety of modifications in the microscopes for specialized viewing.*
- 4. Understand several separation techniques which may be required to be handled by microbiologists.*

Course Name: Bacteriology and Virology
Course Code: BSCHMCBGE201

Course Type: GE	Course Details: GEC2		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course learning outcomes: *By the conclusion of this course, the students will -*

- 1. Acquired a fairly good understanding of the different types of bacteria and viruses.*
- 2. Acquired a fairly good understanding of the structure and other salient characteristics of bacteria and viruses.*
- 3. Acquired skills of visualizing bacteria by staining, using a microscope and culturing bacteria in microbiological media to describe the features of bacterial colonies.*

Semester-III

Course Name: Virology
Course Code: BSCHMCBC301

Course Type: C	Course Details: CC-5		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: By the conclusion of this course, the students will -

1. Understood what are viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria (bacteriophages)
2. Understand about the biology of bacteriophages.
3. Gained knowledge of a variety of plant viruses and animal viruses.
4. Gained ability to describe role of viruses in the causation of the cancer

Course Name: Microbial Physiology and Metabolism
Course Code: BSCHMCBC302

Course Type: ...C	Course Details: CC-6		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: By the conclusion of this course, the students will be capable of-

1. Describing the growth characteristics of the microorganisms capable of growing under unusual environmental condition of temperature, oxygen, and solute and water activity.
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.
3. Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms.

Course Name: Cell and Molecular Biology
Course Code: BSCHMCBC303

Course Type: ...C	Course Details: CC-7		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students will capable of –*

- 1. Describing importance and mechanism of central dogma of life*
- 2. Describing the structure and function of different components of cell.*
- 3. Differentiating the cellular and molecular processes between prokaryotes and eukaryotes.*

Course Name: Microbial Quality Control in Food & Pharmaceutical Industries

Course Code: BSCHMCBSE301

Course Type: SE	Course Details: SEC-1		L-T-P: 4 - 0 - 0		
Credit: 4	Full Marks: 50	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		--	10	--	40

Course learning outcomes: *By the conclusion of this course, the students will -*

- 1. Developed a very good understanding of practical aspects of microbiological safety, various detection methodologies and use of different microbiological media in food industries.*
- 2. Developed a very good understanding of practical aspects of microbiological safety, various detection methodologies and toxicological testing of products in the pharmaceutical industries*

Course Name: Microbial Diagnostics and Public Health

Course Code: BSCHMCBSE302

Course Type: SE	Course Details: SEC-1		L-T-P: 4 - 0 - 0		
Credit: 4	Full Marks: 50	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		--	10	--	40

Course learning outcomes: By the conclusion of this course, the students will -

- 1. 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.*
- 2. Developed a very good understanding of practical aspects of antibiotic sensitivity testing, water and food testing skills using kits available in the market.*

Course Name: Industrial and Food Microbiology

Course Code: BSCHMCBGE301

Course Type: GE	Course Details: GEC-3		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course learning outcomes: By the conclusion of this course, the students-

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

Semester-IV

Course Name: Microbial Genetics
Course Code: BSCHMCBC401

Course Type: C	Course Details: CC-8		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students will -*

- 1. Understood genome organization of model organisms namely E. coli and Saccharomyces, and the molecular mechanisms that underlie mutations.*
- 2. 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.*
- 3. Be able to describe different types of the extra-chromosomal elements or the plasmids; the nature of the transposable elements in the prokaryotic and the eukaryotic cells.*
- 4. Gain hands on skills of isolation of plasmid DNA from bacterial cells and its visualization by performing agarose gel electrophoresis.*

Course Name: Environmental Microbiology and Microbial Ecology
Course Code: BSCHMCBC402

Course Type: C	Course Details: CC-9		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the completion of this course, the students will -*

- 1. 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.*
- 2. Be 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*
- 3. Understood the significance of BOD/ COD and various tests involving use of enumerating fecal E. coli for assessing quality of water.*

4. Developed the practical skills for conducting experiments to assess the BOD/COD of waste waters and their interpretation; practically assess the portability of drinking water by the use of standard microbiological tests.

Course Name: Industrial Microbiology
Course Code: BSCHMCBC403

Course Type: C	Course Details: CC-10		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: By the conclusion of this course, the students will -

1. Be capable of describing a large number of substrate that are used for the industrial fermentation processes.
2. Developed an understanding of different types of reactors or fermenters which are used for laboratory, pilot and industrial scale fermentations and their processes parameters.
3. Acquired a detailed knowledge of number of products which are produced by industrial fermentation processes.

Course Name: Food Fermentation Techniques
Course Code: BSCHMCBSE401

Course Type: SE	Course Details: SEC-2		L-T-P: 4 - 0 - 0		
Credit: 4	Full Marks: 50	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		0	10	0	40

Course Learning Outcomes: By the conclusion of this course, the students will -

1. Develop a very good understanding of practical aspects commercially produced food and fermentative products.
2. Develop a very good understanding of practical use of microbiology for better production of home-based food and fermentation products for day-to-day use

Course Name: Microbial Products
Course Code: BSCHMCBSE402

Course Type: SE	Course Details: SEC-2		L-T-P: 4 - 0 - 0		
Credit: 4	Full Marks: 50	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		0	10	0	40

Course Learning Outcomes: *By the conclusion of this course, the students-*

- 1. Have developed a very good understanding of practical aspects of production of bio fertilizers.*
- 2. Have developed a very good understanding of practical aspects of the production of bio pesticides/ bio insecticides.*

Course Name: Genetic Engineering and Biotechnology

Course Code: BSCHMCBGE401

Course Type: GE	Course Details: GEC8		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students-*

- 1. Has acquired a fairly good knowledge of the tools and the methods for genetic engineering.*
- 2. 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.*
- 3. Students can perform isolation of DNA, amplification of any gene by PCR and its analysis by gel electrophoresis.*

Semester-V

Course Name: Medical & Veterinary Microbiology and Immunology
Course Code: BSCHMCBC501

Course Type: C	Course Details: CC-11		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students will clearly -*

- 1. 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.*
- 2. Develop a thorough understanding of common bacterial, viral, fungal, parasitic diseases of human being including some very important diseases of the animals also.*
- 3. 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.*
- 4. Able to conduct experiments for growing common bacteria in different microbiological media, antibiotic sensitivity determination and antigen antibody reaction (precipitation test in the agarose)*

Course Name: Agriculture, Food and Dairy Microbiology
Course Code: BSCHMCBC502

Course Type: C	Course Details: CC-12		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students will clearly -*

- 1. Develop a understanding of the multifarious roles of microorganisms in soil, in association with plants and thus in the field of agriculture.*
- 2. Able to describe the role of microorganisms in the production of food, its spoilage, including their role in homemade fermented foods.*
- 3. Able to identify the role of microorganisms in the causation of the diseases and how to protect against food-borne pathogens.*
- 4. Develop experimental skills for testing the milk and different foods for the presence of microorganisms*

Course Name: Biophysics, Biomathematics & Biostatistics
Course Code: BSCHMCBDSE501

Course Type: DSE	Course Details: DSEC-1 or 2		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students clearly-*

- 1. Understand the basic physical parameters of cells or biological processes and basic methods used to study these.*
- 2. Have developed basic knowledge of mathematics as applied to biological phenomenon.*
- 3. Have developed basic concepts of statistics and their importance*

Course Name: Heredity and Evolution
Course Code: BSCHMCBDSE502

Course Type: DSE	Course Details: DSEC-1 or 2		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students have -*

- 1. Developed perception of evolution taking examples from well-studied models organisms of bacteria, fungi and other organisms.*
- 2. Good understanding of concepts of Mendelian genetics and structural organizations of chromosomes.*
- 3. Developed practical skills to do karyotyping and pedigree analysis*

Course Name: Microbial Biotechnology
Course Code: BSCHMCBDSE503

Course Type: DSE	Course Details: DSEC-1 or 2		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students have -*

- 1. Developed an understanding how microbiology is relevant to technological developments for agriculture and environment.*
- 2. Developed an understanding how microbiology is relevant to technological developments for industries related to food and fermentations.*

- Developed an understanding how developments in recombinant DNA technology is juxtaposed with microbially-based technological developments for agriculture, industry and environment.

Semester-VI

Course Name: Advanced Microbiology
Course Code: BSCHMCBC601

Course Type: C	Course Details: CC-13			L-T-P: 4 - 0 - 4	
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: By the conclusion of this course, the students will –

- Explain salient characteristics of genomes of representative microorganisms.
- Understood the concept and importance of metagenomics.
- Develop an initial understanding of recent developments of host-microbe interactions, synthetic biology, viable but non-culturable forms of microorganism etc.
- Able to extract DNA from bacteria / soil and perform PCR for 16s Ribosomal genes using universal primers and interpret the results.

Course Name: Recombinant DNA Technology
Course Code: BSCHMCBC602

Course Type: C	Course Details: CC-14			L-T-P: 4 - 0 - 4	
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: By the conclusion of this course, the students will -

- Acquire a fairly good knowledge of the tools and the methods for genetic engineering.
- Acquire 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.
- Be able to perform isolation of DNA, amplification of any gene by PCR and its analysis by gel electrophoresis.

Course Name: Project Work on Microbiology of Societal Importance
Course Code: BSCHMCBDSE601

Course Type: DSE	Course Details: DSEC-3 or 4		L-T-P: 0 - 0 - 12		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60		40	

Course Learning Outcomes: *By the conclusion of this course, the students-*

- 1. Developed skills to design small project.*
- 2. Should develop the habit of teamwork and perform experiments related to the project.*
- 3. Developed basic skills for data retrieval, representation, analysis and interpretation.*

Course Name: Basic Computer and Bioinformatics
Course Code: BSCHMCBDSE602

Course Type: DSE	Course Details: DSEC-3 or 4		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the conclusion of this course, the students-*

- 1. Developed skills to use computers for analysis of biological data.*
- 2. Skill to use important biological databases, use tools to retrieve data, and compare the data of the biological macromolecules*
- 3. Developed basic skills for data retrieval, representation, analysis and interpretation*

Course Name: Mycology and Phycology
Course Code: BSCHMCBDSE603

Course Type: DSE	Course Details: DSEC-3 or 4		L-T-P: 4 - 0 - 4		
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes: *By the completion of this course the students able to-*

- 1. Describe useful and harmful activities of fungi and algae.*
- 2. Identify commonly available fungi and algae and their characteristics.*
- 3. Discuss how fungi and algae are used as biofertilizers in agriculture and as biopesticides.*
- 4. Grow mushroom in the laboratory.*