

**Dum Dum Motijheel College**  
**Department of Microbiology**

**CBCS curriculum is effective from 2018-'19 Academic year**

**Programme : B.Sc. In Microbiology (Honours)**

**Programme Specific Outcome (PSO) for B.Sc. Microbiology**

	On completion of B.Sc. in Microbiology, our students will be able to :
PSO-01	Demonstrate through knowledge of principles and concepts of basic and applied microbiology.
PSO-02	Demonstrate the presence of microorganisms using different microscopic techniques, and cultivate, isolate, identify, enumerate and preserve them.
PSO-03	Employ safe laboratory practices and follow the rules of biosafety.
PSO-04	Understand biochemical and physiological aspects of microbes and develop broader perspective to identify innovative solutions for present and future challenges posed by microbes.
PSO-05	Demonstrate how the study of microorganisms can provide insights into the working of higher organisms.
PSO-06	Understand microbial life processes and devise strategies to use microorganisms in healthcare, pharma, food, agriculture, beverage, nutraceutical and many other industries to get life-saving and valuable products.
PSO-07	Understand most complex cellular processes with molecular level explanation in most primitive living forms to most complex higher organisms.
PSO-08	Analyze and interpret experimental data statistically.
PSO-09	Impart profound knowledge and understand about the natural protective system i.e. immune system present in different living forms.
PSO-10	Accumulate insight knowledge of concepts of advanced biology like metabolomics, proteomics, genomics, transcriptomics.
PSO-11	Demonstrate the ability to identify ethical issues related to recombinant DNA technology, Genetically Modified Organisms (GMOs), GM foods, intellectual property rights, biosafety and biohazards.
PSO-12	Apply the knowledge of his/her core competency to develop solutions to environmental, social and economic problems.

**Programme : B.Sc. In Microbiology (Honours)****Course Outcomes (COs) for B.Sc. Microbiology****Semester - I****Course title : Introduction to Microbiology and Microbial Diversity****Course code : MCBACOR01T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Know the developmental history of Microbiology and the contributions made by different noted scientists.
CO 2	Understand about the scopes of Microbiology in different fields and their opportunities in different fields.
CO 3	Recognize, name members of the microbial world and state their position on the Universal Phylogenetic tree. Discuss the basic concepts of microbial taxonomy and classification systems.
CO 4	Identify and illustrate various prokaryotic and eukaryotic cells and their structures. Compare and contrast the three cell types of Bacteria, Archaea and Eucarya.
CO 5	Relate structure with function of various cell components and demonstrate their functions using experimentation.
CO 6	Define basic terms and understand principles of microscopy, recognize, illustrate and label various structural components of a microscope and relate structure with function.
CO 7	Cultivate fungi under laboratory conditions and learn the staining technique of fungi.

**Course title : Bacteriology****Course code : MCBACOR02T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Gain profound knowledge about the morphology and structure of Bacterial cells.
CO 2	State nutritional requirements, different types of culture media and growth of bacteria.
CO 3	Understand the effect of Environment on Microbial Growth.
CO 4	Learn different types of staining techniques of bacterial cells.
CO 5	Compare Important features of archaeal and eubacterial groups
CO 6	Isolate pure culture of bacteria.
CO 7	Enumerate bacterial cells.

## Semester - II

**Course title : Biochemistry****Course code : MCBACOR03T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Identify and draw the structures of biomolecules.
CO 2	Describe the role of biomolecules in the biological system, relate the importance of chemical bonds in formation of stable macromolecular structures and discuss the unique properties of water.
CO 3	Know about the structural details of different types of carbohydrates, compare different types of sugars and their properties.
CO 4	Collect structural and functional details of Lipid, Protein and Nucleic acids.
CO 5	Gather information about genetic materials like DNA and RNA.
CO 6	Define terms in enzymology, classify enzymes, and discuss the effect of various factors on enzyme activity.
CO 7	Learn qualitative and quantitative estimation of biomolecules.
CO 8	Know the effects of temperature, pH and heavy metals on enzyme activity.

**Course title : Environmental Microbiology****Course code : MCBACOR04T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Know about the distribution pattern of certain species of microorganisms in different places of the environment, principally bacteria, in order to use them as bioindicators of contamination and other environmental impacts.
CO 2	Understand extremophiles and life in extreme and unusual little-explored habitats
CO 3	Gain advanced knowledge of microbial interactions and microbial processes in the environment.
CO 4	Describe principles of microbial ecology, illustrate, compare and contrast the biogeochemical cycles and state the significance of each cycle and the overall interconnection between them.
CO 5	Learn the modern and advanced techniques of waste management.
CO 6	Estimate the presence and load of microorganisms in different parts of environment.
CO 7	Use diverse array of microorganisms for the detoxification of environmental pollutants in the form of Bioremediation and help in sustainable development.

### Semester - III

**Course title : Microbial physiology and metabolism**

**Course code : MCBACOR05T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Know about physiology of microorganisms.
CO 2	Understand the process of nutrient transport and the importance of it in living system, especially in microbial cells.
CO 3	Define catabolism and anabolism occur in different microorganisms under different conditions.
CO 4	State the role of ATP and reducing power in metabolism, describe the processes for ATP generation.
CO 5	Differentiate between fermentation and respiration.
CO 6	Estimate the effects of pH, Temperature, Carbon and Nitrogen sources on a specific model bacteria, <i>E.coli</i>
CO 7	Demonstrate alcoholic fermentation in the laboratory using normal substrates.

**Course title : Cell Biology**

**Course code : MCBACOR06T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Learn about the structural and functional aspects of different components of eukaryotic cells.
CO 2	Analyze and explain the basic mechanisms of protein sorting and transport in living cells.
CO 3	Understand the components involved, molecular mechanism and importance of cell signaling both in microbial and eukaryotic system.
CO 4	Describe the eukaryotic cell cycle, the different phases of eukaryotic cell division and compare and contrast mitosis and meiosis
CO 5	Compare apoptosis and necrosis.
CO 6	Adopt advance knowledge of cancer biology.
CO 7	Learn the cytochemical staining technique of DNA.

**Course title : Molecular Biology**

**Course code : MCBACOR07T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Describe, draw and differentiate between the structures of DNA and RNA, compare different forms of DNA.
CO 2	Explain chromatin structure, differentiate between euchromatin and heterochromatin, illustrate and explain organization of DNA in prokaryotic and eukaryotic chromosome, state the significance of histones, nucleosomes, kinetochores, centromere and telomeres.
CO 3	Illustrate the process of DNA replication, transcription and translation, also describe the enzymes involved in the processes.
CO 4	Explain the central dogma of molecular biology, predict the polypeptide sequence of a given DNA fragment.
CO 5	Understand the molecular mechanism to regulate gene expression in living cells.

CO 6	Isolate, visualize, purify and estimate cellular DNA, RNA and protein from microbial cells.
CO 7	Run gel electrophoresis to separate nucleic acids and proteins.

**Course title : Food fermentation technique.**

**Course code : MCBSSEC01M**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Define different kinds of prebiotics and probiotics.
CO 2	Explain different beneficial health aspects of pro and pre-biotics.
CO 3	Illustrate the industrial process of making important fermented food from normal natural substances.
CO 4	Demonstrate microbial strain development in food and beverage industries.
CO 5	Illuminate the down stream processing of fermentation process in industry

### Semester IV

**Course title : Microbial genetics**

**Course code : MCBACOR08T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Define and describe the basic terminology in genetics and describe, analyze and interpret the results for various experiments in genetics.
CO 2	Describe mutation and different kinds of agents causing mutation (mutagens).
CO 3	Explain the effects of molecular mutagens on microbial cells.
CO 4	Know about extrachromosomal inheritance of microbial cells and the advantages to inherit those molecules.
CO 5	Illustrate natural gene transfer mechanisms occurring in microbial cells.
CO 6	Explain about transposable genetic elements of microbial cells and the mechanism of transposition.
CO 7	Prepare master plates of microbial culture and the replica of that.

**Course title : Virology**

**Course code : MCBACOR09T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Explain diversity, architecture, classification and nomenclature of virus.
CO 2	Discuss mechanism of viral entry and multiple mode of multiplication in host cells.
CO 3	Describe diverse array of host response mechanism to viral infection.
CO 4	Explain the mechanisms of different viral diseases and illustrate the diagnosis, control and prevention of viral diseases.
CO 5	Illuminate oncogenic virus and their pathophysiology.
CO 6	Explain the limitations of antiviral agents and estimate the success story of advanced antiviral agents.
CO 7	Demonstrate the plaque assay and the enumeration of viral count.

**Course title : Food and Dairy Microbiology**

**Course code : MCBACOR10T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Understand the significance and activities of microorganisms in food the role of intrinsic and extrinsic factors on growth and survival of microorganisms and attain information on microbial food spoilage.
CO 2	Describe the principles in traditional food preservation techniques including salting, pickling, refrigeration, freezing, oxidation, and canning/bottling and chemical preservation.
CO 3	Analyze types of starter cultures like Lactic acid bacteria, fermented milk products, probiotics, SCP and Edible mushrooms.
CO 4	Acquire & remember the microbes causing food intoxications and food infections.

**Course title : Microbiological analysis of air and water**

**Course code : MCBSSEC02M**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Describe and demonstrate the microbial abundance, distribution and significance in air and water.
CO 2	Understand the concept of Bioaerosols, fate of Bioaerosols and different inactivation mechanisms of Bioaerosols.
CO 3	Analyze the microbial standard of Potable or drinking water.
CO 4	Estimate the coliforms present in any water sample by IMViC test and predict the total microbial load in a water body by Most Probable Number count.
CO 5	Describe the disease mechanisms of air and water borne pathogens.

## Semester V

### Course title : Industrial Microbiology

#### Course code : MCBACOR11T & P

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Understand the basics of fermentation technology, screening techniques, microbial culture preservation techniques etc.
CO 2	Know the concepts of inoculum development and media sterilization for fermentation process.
CO 3	Learn about the typical structure of fermenter and its parts, types of fermentation processes and synchronous growth.
CO 4	Aware about the detail downstream process of fermentation of important microbial products.
CO 5	Demonstrate the processes adopted in the industry to get specific fermentation products like Ethanol, Citric acid, Vit.B12, Penicillin, Amylase etc.
CO 6	Immobilize the microbial enzymes produced by fermentation technique.
CO 7	Translate the academic knowledge into industry.

### Course title : Immunology

#### Course code : MCBACOR12T & P

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Learn about the structural features of the components of the immune system as well as their function.
CO 2	Understand basic concepts of Immunology, properties of immune system and types of immunity.
CO 3	Compare and contrast the innate versus adaptive immune systems. Also compare and contrast humoral versus cell-mediated immune responses.
CO 4	Understand the concepts of antigen and immunogen. Distinguish and characterize antibody isotypes, development, and functions
CO 5	Explain the role of cytokines in immunity and immune cell activation; and be able to identify and characterize cytokines of particular immune importance.
CO 6	Understand the significance the Major Histocompatibility Complex in terms of immune response and transplantation.
CO 7	Illustrate the mechanism of complement activation and function.
CO 8	Describe the immunological disorders like Autoimmunity and Hypersensitivity.
CO 9	Demonstrate different modern immunological techniques like ELISA, ELISPOT, Western blotting, Precipitation, Agglutination, Flow cytometry etc.
CO 10	Elucidation of immunodiagnostic procedures and monoclonal antibodies.

### Course title : Biomathematics and Biostatistics

#### Course code : MCBADSE02T & P

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Recognize the definition of statistics, its subject and its relation with the other sciences
CO 2	Collect data relating to variable/variables which will be examined and calculate descriptive statistics from these data



CO 3	Identify distribution form relating to the variable/variables.
CO 4	Define some concepts about hypothesis testing and apply hypothesis testing to the data through these concepts.
CO 5	Arrange the results of the hypothesis testing and make a statistical decision.
CO 6	Define the principal concepts of probability and equate to resolve the problems.

**Course title : Inheritance Biology****Course code : MCBADSE03T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Understand the basic concepts of heredity and genetics including Mendelian genetics.
CO 2	Acquainted with genetics of single gene, polygenic and chromosomal disorders.
CO 3	Understand the complex concepts of multiple allele and different types of genetic interactions, incomplete dominance, co-dominance, Epistasis, penetrance, expressivity etc.
CO 4	Know about genetic Linkage, Crossing over and extrachromosomal inheritance in eukaryotic systems.
CO 5	Explain the concepts of genetic recombination.
CO 6	Analyze pedigree and conclude the relation of a disease with gene/s.
CO 7	Illustrate genetic disorders caused by structural and numerical chromosomal abnormalities.

## Semester VI

### Course title : Medical Microbiology

#### Course code : MCBACOR13T & P

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Describe the human anatomy and diverse array of microorganisms present under normal condition in different parts of human body.
CO 2	Explain the modes of transmission, pathogenesis, diagnosis, prophylaxis, and treatment of some significant pathogens that establish infection.
CO 3	Describe the process of clinical specimen collection, handling and transport, and demonstrate multiple methods of pathogen identification from clinical specimen.
CO 4	Explain the pathophysiology of different Bacterial, Viral, Fungal and Protozoan diseases.
CO 5	Compare the mode of action of the principal groups of antibacterial agents.
CO 6	Elucidate the mechanisms of microbial drug resistance and describe methods of testing.
CO 7	Demonstrate medically important tests to identify and signify antimicrobial agents.

### Course title : Recombinant DNA Technology

#### Course code : MCBACOR14T & P

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Understand the concepts of Recombinant DNA technology and Biotechnology.
CO 2	Illustrate the strategies, tools and methods of molecular cloning.
CO 3	Demonstrate nucleic acid sequencing methods and amplification techniques like, PCR, RT-PCR and Real Time PCR.
CO 4	Discuss the practical aspects of applying recombinant DNA technology in different fields to get the beneficial results for mankind.
CO 5	Explain the significance of model organisms in recombinant DNA technology.
CO 6	Describe the construction different DNA libraries like c-DNA and Genomic DNA libraries.
CO 7	Illustrate recombinant gene amplification and expression systems.

### Course title : Microbes in Sustainable Agriculture and Development

#### Course code : MCBADSE04T & P

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Realize of the various beneficial effects of soil microorganisms on soil health, which is instrumental in the production of food and fibre. Conversely, learned that some soil microbes are deleterious to agronomic crops.
CO 2	Describe taxonomical, physiological, and environmental aspects of soil microorganisms.
CO 3	Illustrate the roles of soil microbes, such as decomposing dead organic matter, enriching the soil with nutrients, increasing water infiltration, improving soil texture, etc.
CO 4	Learn that the soil is an excellent habitat for multitude of microorganisms balancing the soil ecosystem.

CO 5	Focus on using soil microorganisms to fight against plant pathogens and sustainable development.
CO 6	Describe the beneficial use of Biogas, Biofuels and Bio manure.
CO 7	Acquainted with the biofertilizer production technology and the bottlenecks in the technology.
CO 8	Explain the production of genetically modified agricultural products and their roles.

**Course title : Instrumentation and Biotechniques**

**Course code : MCBADSE06T & P**

Sl. No.	On completion of the course in Microbiology, our students will be able to :
CO 1	Describe the applications of Biophysical principles in biological techniques.
CO 2	Demonstrate the knowledge and skills of using instruments in biological fields.
CO 3	Perform techniques involved in molecular biology for the diagnosis of different diseases.
CO 4	Learn number of techniques to separate biomolecules from mixtures
CO 5	Understand the fundamental concept and applications of the instruments that are routinely used for the characterization of biomolecules.