



DHRUBA CHAND HALDER COLLEGE

(FORMERLY DAKSHIN BARASAT COLLEGE)

ESTD. - 1965

A NAAC Accredited Degree College Affiliated to University of Calcutta

P.O. - Dakshin Barasat Dist. - South 24 Parganas West Bengal Pin - 743372

E-mail: dchcollege@yahoo.com, Website: www.dchcollege.org

Phone: (03218) -222550 (Prin.) /223-668 (Off.)

Ref. No.

Date20

Department of Microbiology

Under Graduate Programme

Programme Specific Outcome (PSO) in Microbiology

Microbiology, an interdisciplinary subject in its core course prepares students for knowing the basics of both theory and practical; further focuses on the overlapping domains with the other streams of biology.

The main objective of the program is to train the students about the knowledge of microbiology and ignite young minds to think innovatively and nurture scientific temper as an outcome of attending several awareness programs, scientific lectures, and interactive sessions and thereby set their career and professional goals.

PSO-1: To provide detailed knowledge about the history of development of the subject through the ages, the awareness about the stalwart discoveries; different groups of microbes from primitive to newly evolved one; modern hierarchial and taxonomical status

PSO-2: To make the students familiar with the scope of applied field of the subject in areas like food environment ,agriculture & biofertilizers, microbial genetics,vaccines, immunology, , molecular biology, recombinant DNA technology, medical & pharmaceuticals, Virology and hence utilization in the research and industrial sectors.

PSO-3: To prepare the students with the knowledge related to laboratory based studies, hands-on-training, skill development for high-end instrument operation.

PSO-4: To provide knowledge to the students about the potential of microbiological studies to become an entrepreneur in agricultural and small-scale industrial aspect.

PSO-5: To provide the knowledge about the environmental issues, intervention of microbial consortia and microbial physiology for development of cleaner technology and hence sustainable development.

PSO-6: Microbiome literacy for better management of human health, environment and societal problems

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PSO-7: Enable the students to develop aptitude to study the subject in its interdisciplinary aspects and have some basic knowledge in biophysical chemistry, bioinformatics, biochemistry, Plant Pathology, metagenomics, Genetics, IPR etc.

PSO-8: To enable the students pursue M.Sc/ M.Tech or Medical degree and eventually earn Doctoral/Post Doctoral fellowship either at national or international level. Help the students to build the successful career in Microbiology either in academy or in industry.

PSO-9: Inculcate scientific, analytical and problem solving skills developed by microbiology graduates which are high in demand by employers especially at industry level.

COURSE OUTCOME

THREE-YEAR HONOURS COURSE OF STUDIES IN

MICROBIOLOGY

Semester I

CC1: Introduction to Microbiology & Microbial Diversity

Theory

Unit 1: History of Development of Microbiology

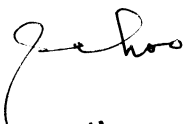
Develop a good knowledge about the development of the discipline of Microbiology and the contributions made by prominent scientists in this field. To be aware about the History of Microbiology as well as to be concerned about its development.

Unit 2: Diversity of Microbial World

Develop a very good understanding of the characteristics of different types of microorganisms (cellular & acellular), methods to organize/classify these, and basic tools to study these in the laboratory.

Unit 3: An overview of scope of Microbiology

To know the varieties of scope regarding Microbiology and apply it on practical field. Students shall gain knowledge as to how microbes can be put to work in many ways; making life savings drugs, the manufacture of biofuels, cleaning up pollution, producing food and drink; how they contribute to digestion, promote development of the immune system and detoxify harmful chemicals. Microbes are vitally important to all life forms on earth. As versatile organisms, they play a major role in various biochemical processes such as biodegradation, biodeterioration, climate change, food spoilage, epidemiology and biotechnology.


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Practical

Introduction to Microbiology and Microbial Diversity

Knowledge about an ideal Microbiological Laboratory. Develop good laboratory practices. Adopt sterilization techniques, media preparation. Able to perform basic experiments to grow and study microorganisms in the laboratory. Exposure to concept of various microorganism through permanent slides. Understand principles of sterilization of culture media, glassware and plastic ware to be used for microbiological work.

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.

Learned handling and use of microscopes for the study of microorganisms which are among the basic skills expected from a practicing microbiologist. They also get introduced to a variety of modifications in the microscopes for specialized viewing.

Understand several separation techniques which may be required to be handled by microbiologists.

CC2: Bacteriology

Theory

Unit 1: Cell organization

Describing the importance and mechanism of the central dogma of life

Describing the structure and function of different components of a cell.

Differentiating the cellular and molecular processes between prokaryotes and eukaryotes. Describe characteristics of bacterial cells, cell organelles, cell wall composition, and various appendages like capsules, flagella, or pili.

Unit 2: Bacteriological Techniques

Acquired skills in visualizing bacteria by staining, using a microscope and culturing bacteria in microbiological media to describe the features of bacterial colonies. Understand the concept and importance of metagenomics.

Develop an initial understanding of recent developments in host-microbe interactions, synthetic biology, viable but non-culturable forms of microorganism etc.

Unit 3: Microscopy

Introduction to Microscopy, its different types in optical and electron based microscopy. Also presentation involved working principles of Optical, SEM & TEM microscope with their components working description. All microscope deeply discussed about the contrast, application, advantages & disadvantages. Light microscopy is the simplest form of microscopy. It has tools that are used to observe the small organisms or object and even macromolecules. It has wide variety of microscopic tools for studying the biomolecules and biological processes.. It includes all forms of microscopic methods that use electromagnetic radiation to achieve magnification.

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Unit 4: Growth & Nutrition

Describe the nutritional requirements of bacteria for growth; develop knowledge and understanding that besides common bacteria there are several other microbes that grow in extreme environments. Describing the growth characteristics of the microorganisms capable of growing under the unusual environmental condition of temperature, oxygen, and solute and water activity. Describing the growth characteristics of the microorganisms which require different nutrients for growth and the associated mechanisms of energy generation for their survival like autotrophs, heterotrophs, chemolithoautotrophs, etc. Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms.

Unit 5: Reproduction

Know the different types of reproduction in bacteria, understand the process of binary fission and other types of asexual reproduction, find a mathematical expression for measuring growth, understand the different types of genetic recombination in bacteria.

Unit 6: Bacterial Systematics

Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups, assign names, identify them. Updated knowledge about archae and eubacterial systematics and taxonomy as per International Code. Guidance for use of Bergy's Manual.

Unit 7: Important Archaea & eubacterial groups

Acquire a fairly good understanding of the Diversity of the microbes both archae bacterial and eubacterial genera. Cyanobacteria in particular.

Practical

CC2: Bacteriology

Perform basic laboratory experiments to study microorganisms; preparation of different types of media, adopt various staining techniques, methods to isolate and preserve bacteria in the laboratory; estimation of cfu by pour plate /spread plate method.

Understand principles that underlie sterilization of culture media, glassware and plastic ware to be used for microbiological work.

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.

Learned handling and use of microscopes for the study of microorganisms which are among the basic skills expected from a practicing microbiologist. They also get introduced to a variety of modifications in the microscopes for specialized viewing.

Understand several separation techniques which may be required to be handled by microbiologists.

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Semester 2

Theory

CC3: Biochemistry

Unit1: Bioenergetics

Acquire a clear knowledge of the biophysical chemistry module which will enhance the students ability to correlate the knowledge wherever applicable in the course/semester module.
Develop a very good understanding of various bio-molecules which are required for the development and functioning of a bacterial cell.

Unit 2: Carbohydrates Unit 3: Lipids Unit 4: Proteins Unit 5: Enzyme Unit 6: Vitamins

Understand how the carbohydrates make the structural and functional components such as energy generation and storage of food molecules for the bacterial cells
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.
Able to make buffers, study enzyme kinetics and calculate V_{max} , K_m , K_{cat} values.

Practical

Vivid knowledge and hands-on-training on biochemical experiments like qualitative and quantitative estimation of carbohydrates, lipids, proteins, vitamins----- the important biomolecules and building blocks of the living system; additionally a detailed workout for enzymology.

CC4: Cell Biology

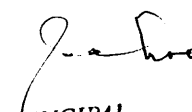
Theory

Unit 1&2

Detailed review of structural and functional organization of the cell(both prokaryotic & eukaryotic) including important organelles with special reference to nucleus, the controlling centre of the cell and nuclear organization.

Unit 3

Understanding the role of cell organelles involved in protein manufacture, its functional aspect(sorting & transport).


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Unit 4&5

Understanding of the physiological and molecular aspects of cell division, cell cycle, cell death, cell renewal and cell signaling; thereby decipher the significance of the events in cellular context.

Practical

Microscopical studies on different cellular entities, organelles, hand-on-training for preparation of samples to study cellular division (both mitosis and meiosis).

Semester 3

CC5: Virology

Theory

Unit 1 Nature & Properties of Viruses

To understand the basics of Virology. To get an overview of viral classification, viral characters and history of Virology. To get an overview of the scope of Virology

Unit 2 Bacteriophages

To understand lytic and lysogenic cycles. To understand the role of early & late proteins in viral cycle. To understand the regulation of transcription in lambda phage.

Unit 3 Viral Transmission, salient features of viral nucleic acids & replication

Basic concepts of Baltimore classification. To know about replication strategies, multiplication, capping and tailing mechanisms, release of virions. To get basic idea about alternative splicing, terminal redundancy, long terminal repeats etc.

Unit 4 Viruses and Cancer

To acquire basic knowledge about oncogenic virus. To understand the basic concepts of oncogene and proto oncogene.

Unit 5: Prevention and control of viral disease

Students should be familiar with different antiviral compounds as well as should know their mode of action. To get clear concept about interferon and its mode of action.

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Unit 6: Application of Virology

Develop clear concept about how the knowledge of virology can be applied in recombinant DNA technology, gene therapy, phage display.

Practical

Practical training for Plaque assay. Study of the structure of important plant, animal and bacterial virus using electron micrographs. Study of CPE of virus using electron micrographs.

CC6: MICROBIAL PHYSIOLOGY AND METABOLISM

Theory

Unit 1: Microbial growth and effect of environment on microbial growth

To understand the concept of batch culture, continuous culture, growth curve, generation time, diauxic growth curve. To get clear idea about autotroph, heterotroph, chemolithotroph, chemolithoautotroph, photolithoautotroph, photoorganoheterotroph.

Unit 2: Nutrient uptake and Transport:

To gather knowledge about passive and facilitated diffusion. To get the concept of primary and secondary active transport, symport, uniport, antiport.

Unit 3: Chemoheterotrophic Metabolism- Aerobic Respiration

To know about different sugar degradation pathway like; EMP, ED, PPP, TCA cycle. To understand basic concept of ETC, oxidative phosphorylation, uncoupler.

Unit 4: Chemoheterotrophic Metabolism- Anerobic Respiration and fermentation:

To gather knowledge about different types of fermentation: Lactic acid, Alcohol fermentation. To understand the basic concept of linear and branched fermentation.

Unit 5: Chemolithotrophic and phototrophic Metabolism:

To get basic idea about hydrogen oxidation, methanogenesis, oxygenic and anoxygenic photosynthesis. To know about phototrophic microbes, purple and green sulphur bacteria, Cyanobacteria.

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Unit 6: Nitrogen Metabolism:

Basic knowledge about biological nitrogen fixation and hence develop correlation with role of microbes in agriculture. To learn the distinguishing method of assimilatory and dissimilatory nitrate reduction.

Practical

Acquire knowledge and training for study of the nature of the growth of bacteria by turbidometric and standard plate count method; generation time and specific growth rate calculation. Also standardize the effect of various parameters affecting bacterial growth.

CC-7: MOLECULAR BIOLOGY

Theory

Unit 1: Structures of DNA and RNA (genetic material)

To know about Watson Crick model of DNA double helix structure, different types of DNA (A-DNA, B-DNA, Z-DNA). To understand the concept of denaturation, renaturation, significance of cot curve, linking number. Develop concept of mitochondrial and chloroplast DNA.

Unit 2: Replication of DNA in prokaryotes and eukaryotes

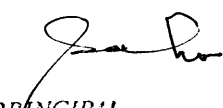
To get basic idea about different replication techniques; Bi and uni directional, rolling circle, theta mode of replication, conservative, semi conservative, dispersive model. To understand the significance of enzymes and proteins involved in replication.

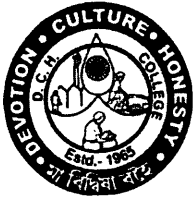
Unit 3: Transcription in prokaryotes and eukaryotes

Basic knowledge about transcription, differential aspects from replication. To get concept about promoter, significance of enzymes and transcription factors involved in transcription.

Unit 4: Post transcriptional processing:

To understand the concepts of split genes, introns and exons, RNA splicing, capping, polyadenylation. To understand the significance of RNA interference.


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Unit 5: Translation in prokaryotes and eukaryotes

Basic knowledge about translation and understand the mechanisms of translation initiation, elongation, termination and role of translational factors. To get the concept of translational inhibitor.

Unit 6: Regulation of gene expression in prokaryotes and eukaryotes:

To know the DNA methylation and Histone acetylation mechanisms for changing chromatin structure. To understand the concept of trp and lac operon.

Practical

Training for quantitative estimation of nucleic acids and method of isolation from bacteria. Hands on experiment of Agarose gel and Poly acrylamide gel electrophoresis. Develop ideas about different types of DNA and RNA using photomicrographs.

SEC A2: BIOFERTILIZER AND BIOPESTICIDES

Theory

Unit 1 Biofertilizer


The students at the end of this unit shall get an overview of the importance, use and benefits of use of biofertilizer. They will understand the advantage of biofertilizer over chemical fertilizer, they will also understand the isolation process, characteristics and field application of different microbes that can be utilized as biofertilizer.

Unit 2 Non symbiotic Nitrogen fixers

Students will understand the isolation process, inoculation, mass production and application of free living nitrogen fixers.

Unit 3 Phosphate solubilizers

Students will understand the isolation process, inoculation, mass production and application of phosphate solubilising microbes.


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Unit 4 Mycorrhizal Biofertilizer

Students will understand the different types of mycorrhiza along with host plant that associated with it. They will learn the importance of production of VAM inoculum and its field application.

Unit 5 Bioinsecticides

The students at the end of this unit shall get an overview of the importance, use and benefits of bioinsecticides. They will understand the advantage of bioinsecticides over chemical insecticides, they will also learn the importance of viral insecticides as well as bacterial insecticides like Bt (*Bacillus thuringiensis*). Enable the students to develop aptitude for field application to control pests.

Semester 4

CC-8: MICROBIAL GENETICS

Theory

Unit 1 Genome Organization and Mutations

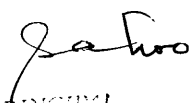
To acquire knowledge about mutations and mutagenesis: Physical and chemical mutagens; Molecular basis of mutations; Functional mutants (loss and gain of function mutants); Uses of mutations Reversion and suppression: True revertants; Intra- and inter-genic suppression; Mutator genes . To understand the basic concepts of Ames Test.

Unit 2 Plasmids

To know about different types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear plasmids, yeast- 2 μ plasmid., Basic idea about host range, plasmid-incompatibility, plasmid amplification, regulation of copy number, curing of plasmids.

Unit 3 Mechanisms of Genetic Exchange

Basic concept about transformation, Conjugation. To learn the method of distinguishing of Generalized transduction and specialized transduction.


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