

## **DEPARTMENT OF MICROBIOLOGY**

Ram Lal Anand College started offering the program B.Sc. (Honours) Microbiology in the year 1989. This is a three-year undergraduate program. Students are admitted to this course on the basis of marks secured in the 10+2 examination. It has vast prospects due to advancement in the fields of science and technology. It is a broad discipline due to the applications of microbiology in many fields like medicine, pharmacy, food processing, dairy industry, clinical research, water industry, waste management, chemical technology and nanotechnology.

Microbiology has tremendous scope and a very bright future. Being an interdisciplinary course, Microbiology overlaps with other areas of biology such as Genetics, Immunology, Virology, Cell Biology, Molecular Biology, Ecology, Physiology, Bacteriology, Biotechnology and Bioinformatics.

### **Program Offered: B. Sc. (Honours) Microbiology**

Link to Syllabus:

[http://www.du.ac.in/du/uploads/Syllabus\\_2015/B.Sc.%20Hons.%20Microbiology.pdf](http://www.du.ac.in/du/uploads/Syllabus_2015/B.Sc.%20Hons.%20Microbiology.pdf)

### **Program Outcome:**

The University of Delhi is committed to being at the forefront of providing the best tertiary education and acting as a catalyst in shaping a bright and sustainable future for our nation and the world. The outcomes of all programs of the University are reflected in the Graduate Attributes of the University.

These are a set of competencies, skills and abilities that the students develop, along with disciplinary and inter-disciplinary knowledge that they procure through their educational programs. The graduate attributes can be classified under the following domains:

#### **1. Intellectual Development**

Intellectual Development comprises of the following components:

In-depth Domain Knowledge- Understanding of how domain knowledge is created, advanced and renewed.

Interdisciplinary Perspective- Commitment to intellectual openness and developing understanding beyond subject domains.

Competence for Research and Innovation- Ability to initiate, design, conduct, report and supervise independent and original research leading for providing innovative solutions for societal impact.

Analytical Competence- Ability to identify and analyze problems.

Critical Thinking- Ability to evaluate and apply a systematic critical assessment.

Problem Solving Competence- Ability to solve complex issues and problems.

Decision Making- Ability to make sound judgment after considering all facets.

Information Technology Skills- Ability to use software and hardware of an information technology device including specialized software and devices.

Ability to Work Independently-Learn to manage work on their own and have solo competence as a decision maker.

Capacity for Creativity – Ability for originality and creativity

## **2. Personal Development**

Personal Development comprises of the following components:

Inter-personal Skills- Cluster of personality traits used to communicate more effectively in professional and personal lives.

Communication Competence- Cultivating ability to communicate knowledge effectively.

Emotional Intelligence- Ability to understand and manage emotions for success at work and socially.

Team Work- Cultivate skills to work in teams and be a team leader.

Collaboration Skills- Ability to work collaboratively and enhance group initiatives.

Time Management- Ability to use time more effectively by planning work and activities well.

Leadership Skills- Demonstrate leadership within discipline and within workplace.

Lifelong Learning- Developing interest to continue to enlarge knowledge understanding and skills

## **3. Professional, Social and Ethical Development**

Professional, Social and Ethical Development comprises of the following components:

Global Citizenship- Encouraging a capacity to thrive in a globalized society, economy and cultures and appreciate global perspectives.

Entrepreneurial skills- Develop skills like resilience, focus, managing people, self-reliance.

Job Skills- Develop soft skills that an employer looks for and as listed in Personal Development.

Appreciation of Diversity and Inclusion – Understanding and respecting diversity and encourage inclusion initiatives.

Cross Cultural Understanding- Develop the ability to respect diverse cultural perspectives and apply knowledge in culturally appropriate manner.

Demonstration of Integrity, Honesty, Responsibility and Ethical Behavior- Understanding the need for ethical conduct, knowledge ethics and ethical standards

Commitment to Community, Society Engagement and National Development- Appreciate local, societal and national issues and contexts related to research and practice

Environmental Awareness- Understanding natural systems and the effect of humans on them

### **Program Specific Outcome:**

A graduate in B.Sc.(H) Microbiology is expected to possess and demonstrate the following domain-related attributes:

1. The ability to appreciate, understand and explain the diversity of the microbial world and various branches of Microbiology such as Bacteriology, Virology and Eukaryotic microbes
2. Comprehensive knowledge about the multitude of applications of Microbiology in fields such as Environmental Microbiology, Industrial Microbiology, Food and Dairy Microbiology, Medical Microbiology, Agriculture, etc.
3. An appreciation of the current state of knowledge and the confidence to design and execute experiments related to Basic Microbiology, Molecular Biology, Physiology, Recombinant DNA Technology, and Microbial Genetics
4. Experience in/Familiarity with the written, verbal and graphic presentation of scientific information
5. The ability to pursue research in the specialization of one's choice incorporating techniques of Basic and Advanced Microbiology under supervision

After successfully completing this program students can pursue M Sc., or integrated M Sc. and PhD in Microbiology, Biotechnology, Biochemistry, Genetics, Plant Molecular Biology, Life Sciences from various universities.

These students can make a career in research and non-research fields.

- Microbiology related careers are found in a diverse range of employment sectors such as; healthcare organizations, environmental organizations, industry – food and drink, pharmaceuticals, toiletries, water and biotechnology companies, forensic science laboratories, publicly funded research organizations, higher education institutions etc.
- Microbiologists work in many different job areas and perform different job roles, such as, Bacteriologists, Industrial Microbiologists, Medical Microbiologists,

Biotechnologists, Biomedical Scientists, Cell Biologists, Geneticists, Mycologists, Protozoologists, Biochemists, Immunologists, Parasitologists, Virologists, Environmental Microbiologists, Food Microbiologists, etc.

Given below is a brief description of expected learning outcomes for various courses (papers) taught as part of this three-year under-graduate program. The program structure is the same as for all Honours Courses in Science, at the University of Delhi.

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- Microbiologists work in many different job areas and perform a variety of different job roles. As Bacteriologists, Industrial Microbiologists, Medical Microbiologists, Biotechnologist, Biomedical Scientist, Cell Biologists, Geneticists, Mycologists, Protozoologists, Biochemist, Immunologists, Parasitologists, Virologists, Environmental Microbiologists, Food Microbiologists

Given below is a brief description of expected learning outcomes of the various papers taught as part of this three-year under-graduate program. The course structure is the same as for all Honours Courses in Science.

### **Core courses:**

**Introduction to Microbiology and Microbial diversity (C1):** Introduces history and scope of microbiology. learning classification general characteristics of microbes like Algae, Fungi Protozoa and introduction about Acellular microorganisms (Virus, Viroid, Prions)

**Bacteriology (C2) :** Bacteriology- the subject offers basic knowledge of bacterial cell organization, aseptic culturing methods, growth conditions, modes of reproduction, different classification approaches in bacterial systematic and details of important taxonomic groups. By studying this paper, students become well equipped with the basic microbiological techniques of growing pure culture of bacterial cells, different staining procedures used to differentiate between the major groups of bacteria, along with good theoretical knowledge about bacterial systems.

**Biochemistry (C3):** The students will have developed an understanding of Laws of thermodynamics, bio-energetics and their applications to biological systems. Will comprehend

enzymes' actions, their kinetic behavior and regulation in the cell. Will become proficient in identifying the building block molecules, sugars, amino acids and fatty acids and their macromolecular counterparts carbohydrates, proteins and lipids respectively and their functions in living organisms.

**Virology (C4):** Learning virus structure, classification and evolution, their ways to infect and exploit host cells for reproduction, their interaction with host organism physiology and immunity, the diseases they cause, the techniques to isolate and culture them, and their use in research and therapy. This Subject considered being a subfield of microbiology or of medicine.

**Microbial physiology and metabolism(C5):** The students will be able to assign microorganisms to their respective nutritional groups with special emphasis on photo-trophy , chemo-trophy and nitrogen metabolism. Will be able to describe the interactions of microorganisms with their environment and the processes employed by them for their survival. Will be able to isolate, culture and monitor the growth of microorganisms.

**Cell biology(C6):** In this subject, the students get a basic knowledge (both theoretical and practical) of the eukaryotic systems with detailed organelle structure and function – Cell wall, Cell membrane, Nucleus, Mitochondria, Chloroplast, Endoplasmic Reticulum and Golgi apparatus, process of cell signaling, cell cycle regulation, cell death by Apoptosis, development and progression of cancers along with types and uses of stem cells

**Molecular biology (C7):** Understanding of chemical and genetic principles that determine the function of macromolecules, regulation of expression of genes within the genome, understanding of the link between basic molecular biology and a variety of human disease

**Microbial genetics and genomics(C8):** Organization of genome and their manipulation *in vitro* as well as *in vivo*

**Environmental Microbiology-C9)** The roles and interactions of microorganisms in the environment are discussed in this paper with applications of microbiology in environmental issues such as sustainable development, bioremediation etc. In this paper, students analyze the diversity and the various functions performed by the microflora present in soil and natural environment

**Food and Dairy Microbiology(C10):** Understanding foods as a substrate for microorganisms; microbial spoilage of foods and their preservation; fermented foods; food borne diseases and methods to ensure food safety during manufacture

**Industrial Microbiology (C11):** Studying construction and operation of different types of fermenters; types of fermentations; isolation, improvement, preservation and maintenance of industrially important strains; Microbial production of metabolites and downstream processing

**Immunology (C12):** Immune response and its mechanism, defense systems in the body and current therapies

**Medical Microbiology (C13):** Understanding host-pathogen interactions; Studying the Etiology, Epidemiology, Pathogenesis, Prophylaxis and Control of some human diseases caused by bacteria, viruses, protozoa and fungi; Modes of action of commonly used antimicrobial agents

**Recombinant DNA technology (C14):** Gene organization and manipulation for therapeutic approaches

### **Discipline Specific Elective**

**Bioinformatics (DSE1):** Organization of biological information in database and analysis tools for better understanding of DNA, RNA and Protein structures. Tools for modelling and New drug design

**Inheritance biology(DSE3):** Understanding pedigrees and role of genetic inheritance in human disorders and syndromes

**Microbial Biotechnology(DSE5):** Studying Applications of Biotechnology in Human Therapeutics, Agriculture, Environment, Biofuels, and Food Technology; Understanding RNAi and Intellectual Property Rights

**Advances in Microbiology (DSE6):** Recent approaches and techniques using basic microbiology in combination with biotechnology and bioinformatics

**Biosafety and intellectual property rights(DSE8):** Understanding patenting rights and importance of Bio -resources and IPR

### **Skill Enhancement**

**Microbial Quality Control in food and pharmaceutical industries(SE1):** Good laboratory practices, important pathogens, food and pharma quality control methods, hazard analysis and hazardous waste management.

1. Microbiological laboratory and safe practices
2. Determining microbes in food/pharmaceutical samples
3. Pathogenic microorganisms of importance in food and water

HACCP for food safety and microbial standards

**Microbial Diagnosis in Health Clinics(SE2):** Learning how to collect various clinical samples; Performing Microscopy, Culturing, Serological and Molecular detection of pathogens; Studying Antibiotic Sensitivity patterns of Bacteria

**Food Fermentation Techniques(SE4):** Food quality, preservation and large scale production techniques

**Management of Human Microbial Diseases(SE5):** Understanding the underlying principles of Diagnosis and Detection of diseases

**Microbiological Analysis of Air and Water(SE6):** Bio-aerosols, hazard analysis and air quality monitoring in hospitals and general surroundings

**Fundamentals of Bioinformatics(SE7)** Organization of biological information in database and analysis tools for better understanding of DNA, RNA and Protein structures. Tools for modeling and New drug design

**GENERIC ELECTIVES OFFERED BY DEPARTMENT OF MICROBIOLOGY TO STUDENTS OF OTHER COURSES**

<b>Semester</b>	<b>Title of GE offered</b>	<b>Scope and Syllabus Web link</b>
Semester I	<b>Introduction and Scope of Microbiology</b>	<a href="http://www.du.ac.in/du/uploads/Syllabus_2015/B.Sc.%20Hons.%20Microbiology.pdf">http://www.du.ac.in/du/uploads/Syllabus_2015/B.Sc.%20Hons.%20Microbiology.pdf</a>
Semester II	<b>Bacteriology and Virology</b>	<a href="http://www.du.ac.in/du/uploads/Syllabus_2015/B.Sc.%20Hons.%20Microbiology.pdf">http://www.du.ac.in/du/uploads/Syllabus_2015/B.Sc.%20Hons.%20Microbiology.pdf</a>
Semester III	<b>Microbial Genetics and Molecular Biology</b>	<a href="http://www.du.ac.in/du/uploads/Syllabus_2015/B.Sc.%20Hons.%20Microbiology.pdf">http://www.du.ac.in/du/uploads/Syllabus_2015/B.Sc.%20Hons.%20Microbiology.pdf</a>