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Part A - Introduction

Programme:
Certificate

Class: B.Sc.

First Year

Session: 2021-22

Subject: Microbiology

1	Course Code-	S1-MBIO1T
2	Course Title	General Microbiology and Cell Structure (Paper I)
3	Course Type	Core Course
4	Pre-requisition	To study this course a student must have had the subject Biology in class 12 th
5	Course Learning Outcomes (CLO)	<p>After completing this course in Microbiology, a student shall have understanding of -</p> <ul style="list-style-type: none"> • Indian traditional knowledge and historical background of Microbiology. • Structure and transmission of Viruses. • Cell structures and cell organization of bacteria. • Different kinds of unicellular prokaryotic and eukaryotic microorganisms based on specific characteristics. • General characteristics of important Eubacteria..
6	Credit Value	4
7	Total Marks	Max. Marks: 25+75 Min. Passing Marks: 33

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Part B – Content of the Course

Total No. of Lectures-60

Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0

Unit	Topics	No. of Lectures
1 c	<p>The Microbial World</p> <p>1.1 Indian traditional knowledge and global historical background of Microbiology.</p> <p>1.2 Theory of Biogenesis, Germ theory of disease, Fermentation.</p> <p>1.3 Significance of microbiology-</p> <p>(a) Branches of microbiology</p> <p>(b) Thrust area of microbiology- Genetic engineering and Biotechnology.</p> <p>1.4 Contribution of following scientists in the field of microbiology - Louis Pasteur, Robert Koch, Edward Jenner, Alexander Fleming, Joseph Lister, Serge N. Winogradsky, Martinus Willem Beijerinck, Dmitrii Ivanowsky, Wendell M. Stanley and Hans Christian Gram.</p> <p>Key words: <i>History of Microbiology, Renowned microbiologists, Genetic Engineering, Biotechnology</i></p>	15
2 p	<p>Acellular and Prokaryotic Microorganisms</p> <p>2.1 Virus – General characters of following viruses – Bacteriophage (T4 and λ phage), Plant viruses (TMV), Prions and Viroids.</p> <p>2.2 Whittaker's System of Five Kingdom Classification: Monera, Protista, Fungi, Plantae and Animalia.</p> <p>2.3 Carl Woese's Three Domain System of Classification: <u>Archaea</u>, <u>Eubacteria</u>, and Eukaryotes.</p> <p>2.4 Bacteria -Study of <i>Spirochete</i>, <i>Rickettsia</i>, <i>Chlamydia</i>, <i>Mycoplasma</i> and Actinomycetes.</p> <p>2.5 Cyanobacteria –Study of <i>Anabaena</i> and <i>Spirulina</i>.</p> <p>Key words: <i>Prokaryotes, Whittaker, Carl Woese, Bacteria, Cyanobacteria</i></p>	15
3 c	<p>Eukaryotic Microorganisms</p> <p>3.1 Basic knowledge of Eukaryotic organisms and their evolutionary pattern.</p> <p>3.2 Fungi –Study of <i>Saccharomyces cerevisiae</i>, <i>Mucor</i>, <i>Aspergillus</i>, <i>Rhizopus</i> and <i>Penicillium</i>.</p> <p>3.3 Protozoa –Study of <i>Euglena</i>, <i>Trypanosoma</i>, <i>Leishmania</i>, <i>Amoeba</i>, <i>Entamoeba</i> and <i>Plasmodium</i>.</p> <p>Key words: <i>Eukaryotes, Fungi, Protozoa</i></p>	15

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<p>4 P</p>	<p>Introduction to Microbial Cell Structure 4.1 Study of Bacteria - Size, shape and arrangement of bacterial cells. 4.2 Structures External to Plasma Membrane – Glycocalyx (capsule, slime layer), flagella, fimbriae, stalk, prostheca and cell wall of Gram +ve and Gram –ve bacteria. 4.3 Structures Internal to Cell wall – Cell membrane, cytoplasm, cytoplasmic inclusions, genome, spores and cysts. 4.4 Reproduction in Bacteria–Binary fission, budding and fragmentation. Key words: <i>Bacterial cells, Gram Positive Bacteria, Gram Negative Bacteria, Binary fission</i></p>	<p>15</p>
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Part A - Introduction			
Programme: Certificate Course	Class: B.Sc.	First Year	Session: 2021-22
Subject : Microbiology			

1	Course Code-	S1-MBIO2T	
2	Course Title	Microbial Techniques (Paper II)	
3	Course Type	Core Course	
4	Pre-requisition	To study this course a student must have had the subject Biology in class 12 th	
5	Course Learning Outcomes (CLO)	<p>After completing this course in Microbiology, a student shall have understanding of –</p> <ul style="list-style-type: none"> • Recall the basic lab glassware to be used in the laboratory. • Summarize different methods of sterilization and isolation of pure cultures. • Understand the working of different kinds of instruments and microscopes. • Apply serial dilution technique to isolate the bacteria. • Practice different methods to culture bacteria in the laboratory • Illustrate a method to differentiate between Gram positive and Gram negative bacteria. 	
6	Credit Value	4	
7	Total Marks	Max. Marks: 25+75	Min. Passing Marks: 33

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B – Content of the Course

Total No. of Lectures- 60

Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0

Unit	Topics	No. of Lectures
1 P.	<p>Microscopy and Staining</p> <p>1.1 Microscopy - Principles and applications of simple and compound Bright-field microscopy, Dark-field microscopy, Fluorescence microscopy, Phase-contrast microscopy, Transmission electron microscopy and Scanning electron microscopy .</p> <p>1.2 Preparation for Light Microscope Examination - Wet-mount and hanging-drop techniques. (iii). Preparation for smear and fixation.</p> <p>1.3 Staining - Principles of staining, negative staining, simple staining, differential staining (Gram and acid fast staining), flagella staining, capsule and endospore staining.</p> <p>Key words: <i>Microscopy, Light microscope, Wet mount, Hanging drop method, Bacterial staining.</i></p>	15
2 P.	<p>Instruments</p> <p>Electronic Balance, Autoclave, Centrifuge, Colony counter, Deep freezer, Homogenizer, Hot air Oven, Incubator, Laminar air flow, Magnetic stirrer, pH Meter, Spectrophotometer, Vortex mixture, Water bath, Water distiller, Chromatography Chambers, Anaerobic chamber and Electrophoresis apparatus .</p> <p>Key words: <i>Instruments in microbiology laboratory.</i></p>	15
3 C	<p>Sterilization and Culture Medium</p> <p>3.1 Physical methods of sterilization - Dry heat, Moist heat, Radiation, Filtration and Incineration.</p> <p>3.2 Chemical methods of sterilization – Phenol and phenolic compounds, Alcohol, Halogens and Detergents.</p> <p>3.3 Types of culture media –Natural, synthetic, complex, enriched and selective. Anaerobic (Thioglycolate broth, Robertson’s media, Microaerophilic), broth culture of aerobic bacteria.</p> <p>Key words: <i>Physical sterilization, Chemical sterilization, Microbial culture media.</i></p>	15
4 e	<p>Isolation, Cultivation and Preservation</p> <p>4.1 Natural microbial population - Pure culture.</p> <p>4.2 Isolation of microbial population - From air, water and soil.</p>	15

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4.3 Methods for isolation - Streak plate, Pour plate and Spread plate. Serial dilution and Micromanipulator methods. Cultivation on liquid and solid media. Isolation of microorganisms on potato slice and bread.

4.4 Maintenance and preservation for short term and long term.

4.5 Cultivation of anaerobic bacteria and accessing non-cultivable microorganisms.

Key words: *Pure culture, Isolation of microbes, Preservation of culture.*

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 SYLLABUS FOR THE DEGREE OF THE BACHELOR OF SCIENCE
 (From 2017-18 onwards)

B.Sc. SECOND YEAR - MICROBIOLOGY
 Paper-II Microbial Genetics and Molecular Biology

MM - 40.00

UNIT I

Structure and genetic material of microbes, Nucleic acid as genetic material, Physical and chemical structure and different forms of DNA. Melting curve of DNA and T_m value determination, Buoyant density of DNA and its relationship with mole (G+C) content in DNA, Types of RNA, mRNA, rRNA, tRNA. Gene structure and functions.

UNIT II

Types of DNA replication, Replication of DNA in prokaryotes and eukaryotes, Conservative, Semi-conservative and Dispersive mode of replication, mechanism of replication, Messelson and Stahl experiment, DNA topology, Supercoiling of DNA and linking number, Enzymes involved in replication of DNA.

Molecular Mechanism of chromosomal replication, Models of chromosomal replication, Cairns model, Rolling Circle model. Translation and transcription in prokaryotes and eukaryotes.

UNIT III

Basic features of genetic code, Biological significance of degeneracy, Wobble hypothesis, Poly cistronic RNA, Overlapping genes, deciphering of genetic code, gene translocation, Ribosomes, and role in protein synthesis, tRNAs, initiation, elongation and termination of protein synthesis in prokaryotes, post translational modification of polypeptides, regulation of protein synthesis, Lac operon, Repressible operon.

UNIT IV

Genetic recombination in bacteria, transformation, conjugation, F factor, Hfr strains, transduction in microbes, plasmids and binary vectors, transposons, transformation techniques, use of bacteria and viruses in genetic engineering.

UNIT V

DNA mutation and repair, types of mutation, evidence of spontaneous nature of mutation, fluctuation test, new comb's experiment and replica testing, mode of action of physical, chemical and biological mutagens-UV rays, nitrous acid, 5-bromouracil, 2-aminopurin, EMS, Reversion in mutation, true reversion, suppression and types of suppressor mutation, DNA repair mechanism, Photo reactivation, excision, mismatch, SOS repair and dealkylation repair.

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(From 2017-18 onwards)

B.SC THIRD YEAR - MICROBIOLOGY

Paper-I Applied and Environmental Microbiology

(MM Theory 40.00)

UNIT I

Design and types of Fermentor, factors affecting fermentation process, Industrial production of alcohol, organic acid economically important enzymes, amino acids, antibiotics, vitamins. Method of immobilization and applications. Strategy for improvement of industrially important microbial strain.

UNIT II

Physical and microbial spoilage of food and food products, spoilage of stored products, fruits and vegetables, spoilage of milk, milk products and meat. Food born diseases. Food preservation methods, asepsis, pasteurization, canning, desiccation, low temperature, anaerobiosis, filtration, chemical preservation of food- salt and sugar, organic acids, use of sulphur dioxide, ethylene and propylene oxides, wood smoke. Applications and production of SCP.

UNIT III

Physical and chemical characteristics of soil, soil microflora, soil fertility and management of agricultural soil, rhizosphere and phyllosphere. Microbial diseases of crop plants with special reference to wheat, rice. VAM and its importance. Nitrogen fixation by symbiotic and non- symbiotic microbes. Use of microbes as biofertilizers, mass cultivation of Rhizobium and Azotobacter, use of blue green algae as biofertilizer.

UNIT IV

Concept of environment in relation to microbes, physiological adaptation in microbes, nature of microbial population in soil, water and air. Microbial interactions - neutralism, commensalism, synergism.

UNIT V

Bioremediation, biomagnification, bioleaching, biopesticides, Microbial H₂ production. Impact of genetically modified organisms. Biodegradation of plastics. Liquid waste disposal, characteristics of solid and liquid waste, sewage treatment - primary, secondary and tertiary treatment.

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(From 2017-18 onwards)

B.SC THIRD YEAR - MICROBIOLOGY
Paper-II Immunology and Medical Microbiology

(MM Theory 40.00)

Unit I

Structure, composition and types of cells and organs involved in immune system. Innate and acquired immunity. Types, structure and functions of MHC molecules, antigen processing and presentation. Humoral and cell mediated immune responses.

UNIT-II

Antigens – structure, properties and types. Haptens and adjuvants. Immunoglobulins- structure, heterogeneity, types and subtypes, physico-chemical and biological properties. Theories of antibody production. generation of antibody diversity. Antigen-Antibody interactions - agglutination, precipitation, immunofluorescence, ELISA, Radioimmunoassays. Hybridoma technology - Production and applications of monoclonal antibodies.

UNIT-III

Tumor immunology –Cancer, origin, oncogenes, tumor antigens, immune response to tumors, tumor evasion of the immune system, immune diagnosis of tumors.

UNIT-IV

Immunization – Modern methods of vaccine production, autoimmunity, hypersensitivity. Immunohematology, antigens of ABO and Rh blood group systems. Medical importance of blood groups- ABO and Rh incompatibility.

UNIT-V

Host microbe interaction, mechanism of pathogenicity. Laboratory strategies in diagnosis of infective syndrome. Bacterial and viral diseases of human - Syphilis, pox, Hepatitis. Fungal diseases of human- Cryptococcus, Candidiasis, Dermatormycosis, sexually transmitted diseases (STDs).

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