MICROBIOLOGY PRACTICALS – (I, II, III)

Distribution of Marks

Min. pass marks: 18	**Duration: 3 hours**	**Max. Marks: 50**
	REGULAR	**EX-STUDENT**
1. Major Exercise	12	12
2. Minor Exercise	10	10
3. Preparation	8	8
4. Spots (5)	10	10
5. Record	5	-
6. Viva-voce	5	10
TOTAL	**50**	**50**

B.Sc. Microbiology Part-II-2013

MB 10- Diversity and scope of Microbiology

Duration : 3 hrs Max .Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

UNIT I

Basic Microbiology and microbial diversity : Binomial nomenclature, Whittaker Kingdom and Carl Woese's three kingdom classification system and their utility, Acellular (prions, Viroids, Viruses) and cellular micro organism

UNIT II

Bacteria and viruses: General characters with emphasis on morphology and cell structure with reference to Archaebacteria (Methanogens, Halophiles , Thermophiles) Cyanobacteria (*Nostoc, Anaebena and Spirulina) Eubacteria (E. Coli, Bacillus, Streptococcus, Staphylococcus, Spirillum* and S*treptomyces*)

General characters of viruses and economic importance with special reference to TMV, Polio virus, Hepatitis virus, T4 and λ Phages.

UNIT III

Fungi and algae: General characters of fungi with emphasis on their occurrence, distributions and structure *with Rhizopus, Aspergillus, Saccaromyces, Agaricus , Neurospora.*

General characters of Algae on their occurrence, distruibution with reference to *Chlamydomonas, Volvox, Spirogyra* and *Ectocarpus.*

UNIT IV

Protozoology: Classification occurrence, morphology, nutrition locomotion, reproduction and economic importance of protozoa. A brief account of *Amoeba, Plasmodium, Leishmania, Tetrahymena, Euglena and Paramecium.*

UNIT V

Biofertilizers – *Rhizobia, Mycorrhiza, Azolla,* Bioluminescence, Biomagnification, Biofilm, cleaning oil spills - superbug, Microbes in composting, Landfills, Bio insecticides, and Biopesticides, Bioremediation and Bioleaching.

MB 11- Cell Biology

Duration : 3 hrs Max .Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

Unit-1

Cell as a basic unit of living systems. The cell theory. Precellular evolution: artificial creation of cells. Broad classification of cell types, PPLOs, bacteria eukaryotic microbes, plant and animal cells. A detailed classification of cell types and tissue within an organism.

Unit-2

Techniques for cell studies: Light microscopy, electron microscopy, Transport across membranes – active and passive transport, ionic gradient, career proteins, Na+ Ka+ pump, ATPase, ABC transportors, Ion channels.

Unit-3

Biochemical structure and composition of cells membrane: protein, lipid, carbohydrates. Structure and function of cell organelles: Cytosol, Mitochondria, Golgibodies, endoplasmic reticulum (rough and smooth), and ribosomes.

Unit-4

Structure and function of cell organelles: chloroplast, lysosomes, peroxysomes, nucleus (Nuclear membrane, Nucleoplasm, nucleolus, chromatin).
Cytoskeletal structures and components actin, microtubules etc.

Unit-5

Cell division, cell cycle (including cell synchrony and its applications). Cell-cell interaction, cell locomotion (amoeboid, flagellar and ciliary), muscle and nerve cell, cell senescence and death, cell differentiation in plants and animals.

MB 12-Molecular biology And Microbial Genetics

Duration : 3 hrs Max .Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

UNIT I

Genome organization in Virus , Prokaryotes and Eukaryotes – Phages λ , *E Coli*, human (Important points from human genomics), Ultra structure of chromatin (Nucleosome and

solenoid structure) Evidence for the role of DNA and RNA as the genetic material. Plasmids and Episome. Transposable elements of prokaryotes and Eukaryotes – Types and significance.

UNIT II

Molecular structure and types of DNA. Molecular structure and types of RNA – m- RNA, t - RNA, r-RNA, Sn- RNA and HnRNA. Gene – definition, number, fine structure, split gene. DNA replication in Prokaryotes and Eukaryotes – detailed mechanism and role of different enzymes and proteins.

UNIT III

Genetic code , Mechanism of transcription in Prokaryotes and Eukaryotes,
Post transcriptional processing – cap formation, tail formation, RNA splicing, mechanism of translation in Prokaryotes and Eukaryotes. Post translation processing.

UNIT-IV

Genetic recombination- various models and mechanism, Conjugation, transformation, transduction and sexduction. DNA damage and repair. Mutation – Spontaneous and induced (physical and chemical mutagen) Molecular mechanism of mutations – point mutation, base substitution, transition and transversion.

UNIT –V

Regulation of gene action in prokaryotes , levels of gene regulation, house keeping genes and regulated genes, induction (Lac operon), attenuation, positive and negative control. Regulation of gene action in Eukaryotes – chromatin organization and role of histones as regulators of gene expression, DNA methylation, enhances and transcriptional factors, Regulation at processing levels–RNA splicing and RNA editing, RNA interference and gene battery model of gene regulation.

MB 13- Basic Immunology

Duration : 3 hrs Max .Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

UNIT I

Introduction - Historical background, general concepts of the immune system. Innate and adaptive immunity.
Structure, properties and functions of the immune cells and organs - T and B lymphocytes, NK cells, monocytes and macrophages, neutrophils, eosinophils and basophils. Mast cells and dendritic cells. Thymus and bone marrow, lymph nodes, spleen, MALT, GALT and SALT.

UNIT II

Antigens and Haptens - Properties (Foreignness, molecular size, heterogeneity). B and T cell epitops. Adjuvents

Antibodies - Structure and functions and properties of antibodies, different classes and biological activities of antibodies, antibody as B cell receptor, antigenic determinants on antibodies (isotype, allo type and idio type).

UNIT III

An overview of maturation and activation of B and T cells.

B cell maturation in bone marrow, humoral immune response, primary and secondary immune response, generation of plasma and memory B cells.

T cell maturation in thymus, generation of effector and memory T cells.

Cell mediated immunity - cell types (NK cells, macrophages)

effector mechanisms and effector molecules of cell mediated reactions.

UNIT IV

Immunological principles of various reactions and techniques :

Precipitation, agglutination, immunodiffusion, immunoelectrophoresis, ELISA (indirect, sandwich, competitive, chemoluminiscence), western blotting, Immunofluorescence, flow cytometry and fluroscence and immunoelectron microscopy.

UNIT V

Hyper sensitivity - types and mechanisms of hyper sensitive reactions.

Auto immunity - Mechanism of induction of organ specific (Hashimoto's thyroiditis, auto immune aneamias, Good pasture's syndrome) and systemic (SLE Multiple sclerosis and rheumatoid arthritis) auto immune diseases. Therapeutic approach.

MB 14-Microbial Physiology

Duration : 3 hrs Max .Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

UNIT I

Growth and transport - Passive and facilitated diffusion, active transport, secondary active transport, group translocation. Specific transport systems - ATP linked ion motive pumps, electroneutral and elecrtrogenic transport. Iron transport.

Growth cycles - one step and diauxic growth curve, primary and secondary metabolite production during different growth phases, Mathematics of growth - geometric and arithmetic growth, calculation of growth rate and generation time. Growth yield.

UNIT II

Effect of environment on microbial growth - Osmolarity, water activity, oxygen, pH, temperature, radiations, pressures. Molecular adaptations to psychrophily and thermophily. Stress responses of extremophiles. Growth limitation by environmental factors, Liebig's law of the minimum, Shelford's law of tolerance.

UNIT III

Carbon metabolism - Glycolysis, ED pathway, phosphoketolase pathway, oxidative pentose phosphate, TCA cycle, glyoxylate cycle, gluconeogenesis, regulatory aspects, Pasteur effect, Harden and Young effect. Carbon dioxide fixation - Calvin cycle, reductive TCA cycle, Heterotrophic carbondioxide fixation.

UNIT IV

Aerobic and Anaerobic respiration in sulphate, nitrate and carbondioxide reducers. Oxidative phosphorylation - mechanism and hypotheses with sepcial reference to Chemiosmotic theory. Chemolithotrophy - Nitrifying bacteria, iron bacteria, hydrogen bacteria, sulphur bacteria, carbon mono oxide bacteria. Reverse electron transport. Phototrophy - Photosynthesis, a historical account. Oxygenic v/s anoxygenic. Mechanism of photosynthesis in bacteria, cyanobacteria, algae.

UNIT V

Bacterial fermentations - Alcoholic, lactic acid, butyric acid, mixed acid, 2, 3 - butanediol, propionic acid and acetic acid fermentations. Fermentations balances, carbon balance, branched v/s linear, fermentation pathways.

Nitrogen metabolism - Physiology of nitrogen cycle. Nitrate reduction - Assimilatory v/s dissimilatory, nitrifiction, denitrification. Biological nitrogen fixation. Mechanism of nitrogen fixation, properties of nitrogenase, Nif genes. Ammonia assimilation.

MB 15- Environmental Microbiology

Duration : 3 hrs Max .Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

UNIT I

Ecology - Development of ecology as a science, its significance and the history and development of microbial ecology. Definition and concept of ecology. Scope of ecology. Autecology and synecology. Ecosystems, components of ecosystems, levels of organizations, trophic levels, food chains, food webs, ecological pyramids and energetics.

UNIT II

Micro organisms and their natural habitats -

Terrestrial environment - Soil, physical and chemical properties of soil, classification of soil, soil profile, soil microflora and soil as a natural habitat for micro organisms.

Aquatic environment - Fresh and marine water microflora, water blooms and eutrophication and biomagnification.
Atmospheric environment - Aero microflora, Air as a medium for mirobial dispersal and vertical distribution of microbes in air, droplet nuclei
Extreme environment - Habitats and microbes : Thermophiles, psychrophiles, barophiles, halophiles, osmophiles, acidophiles etc.

UNIT III

Bilogiocal interaction -
Microbe - Microbe interaction - Symbiosis, synergism, neutralism, commensalism, mutualism, amensalism, competition, parasitism, predation.
Microbe - Plant interaction - Roots, aerial plant surfaces, biological nitrogen fixation (in general)
Microbe - Animal interaction - Rumen micro biology, nematophagus fungi, microbes associated with their (animals) food and nutrition.
Biogeochemical cycles - Carbon cycle, nitrogen cycle, phosphorus cycle, sulphur cycle - manganese cycle, acid mine drainage.

UNIT IV

Sewage and waste management -
Microbial composition of sewage, BOD,COD of sewage. sewage treatment and disposal - Primary, Secondary (aerobic - activated sludge process, trickling filters) and (an aerobic - anaerobic digesters), tertiary treatment.
Solid - waste management - Composting (vermi composting)

UNIT V

Xenobiotic molecules and their recalcitrant nature - Organic pollutant and their degradation (pesticides, synthetic polymers, detergents, hydrocarbons. Biodeterioration of lubricants, cosmetics, pharmaceuticals and leather.Biodegradation of paints, rubber, wood, petroleum and petroleum products and plastics.

MB 16 PRACTICALS

PRACTICAL I
DIVERSITY AND SCOPE OF MICROBIOLOGY + CELL BIOLOGY

1 Study the life history and contributions of the following scientists using photographs: John Dalton, Albert.Einstein, G.J. Mendel, William Harvey, Marie Curie, C.V. Raman, Iasac Newton, Galileo, Euclid, Landsteiner, Barbara McClintock, Anton van Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Martinus W. Beijerinck, SergeiN. Winogradsky, Alexander Fleming, Elie Metchnikoff, Anand M. Chakraborty.

2 Isolation of bacteria, algae and fungi from natural sources using specific media:
a) Nutrient agar.
b) Potato dextrose agar
c) BG-II

3 Study the following with the help of temporary mounts:
a) *Rhizopus, Mucor, Aspergillus, Penicillium.*
b) *Chlamydomonas, Volvox, Spirogyra,* and *Ectocarpus.*

4 Study the permanent mounts of protozoa: *Balantidium, Paramecium, Plasmodium, Euglena, Giardia, Leishmania, Trypanosoma*.

5 Study the following viruses using electron micrographs: TMV, Poliovirus, T4 phage and lambda phages, HIV, Hepatitis B virus.

6 Measurement with the help of light microscope.
7 Calibration of occuIar micrometer. - Measurement of ceI! size . Measurement of chromosome length.
8 Cell counting with haemocytometer and other aids
9 Draw cell shape using Camera Lucida.
10 Separation of cell types from blood and ex-plants by maceration.
11 Study of chromosomal aberrations.
12 Isolation of chromosomal and plasmid DNA. from bacteria.
13 Cytoplasmic preparation
14 Paper chromatography.
15 Thin-layered chromatography.
16 Separation of cell organelles by sucrose gradient.
17 Preparation and study of various stages of mitosis and meiosis.
18 Preparation and study of bone marrow mitosis.
19 Colorimetric estimation of DNA
20 Determination of base composition of DNA.
21 Find out absorption spectrum of the oxidized and reduced form of a molecular species (NAD and NADH).
22 Estimation of RNA by orcinol method.
23 Extraction and estimation of phenol based secondary metabolites

MB 17 PRACTICALS

PRACTICAL II- MOLECULAR BIOLOGY AND MICROBIAL GENETICS + BASIC IMMUNOLOGY.

1 Preparation of master and replica plates

2 To study the effect of chemical (HNO_2) and physical (UV)mutagens on bacterial cells

3 Study of UV survival curve of bacteria

4 Screening for drug resistance

5 Bacterial conjugation

6 Isolation of bacterial chromosomal DNA

7 Isolation of bacterial plasmid DNA
8 Gel electrophoresis of DNA and examination of Agarose gels.
9 Identification of human blood group A,B.AB,O and Rh factor
10 To perform total leucocyte count on the given blood sample.
11 To perform differential leucocyte count of the blood sample
12 To separate serum from the blood sample
13 To perform immunodiffusion by ouchterlony method
14 To perform immuno electrophoresis with a given antigen_antibody system.
15 To perform DOT ELISA
16 Metabolic pathways + General and Microbial genetics Sucrose dcnsity gradient centrifugation. Testing of blood groups
17 Preparation of Amino acid using TL.C.

MB 18 PRACTICALS

PRACTICAL III MICROBIAL PHYSIOLOGY + ENVIRONMENTAL MICROBIOLOGY

1 Physiology of microbial growth; a prokaryotic and eukaryotic system; Growth kinetics using solid and liquid media, colony measurement, dry weight method and turbidometric method.
2 Effect of physiological factors (physical and chemical) on growth of micro organisms, pH, temperature, nitrogen and carbon sources.
3 Aerobic and anaerobic respiration in microbes.
4 ANALYSIS OF Soil : Texture, pH, moisture content, water holding capacity, percolation, capillary action
5 Isolation of Rhizobium from root nodules.
6 Determination of microbial activity in soil and compost (respiratory)
7 Microbial succession on decomposing plant litter (Bacteria and fungi on 28 and 45^0 C)
8 Isolation of microbes (bacteria and fungi) from rhizosphere and rhizoplane
9 Isolation of phosphate solubilizer from soil
10 Isolation of free nitrogen fixers (*Azatobacter, Azospirillium*) from soil.

11 Demonstration of presence of enzymes in soil (Qualitative detection: Dehydrogenase / urease /Amylase)