

**B.Sc. MICROBIOLOGY SYLLABUS**  
**DDU GORAKHPUR UNIVERSITY, GORAKHPUR**

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**B.Sc. II**

B.Sc. II: Three papers and a practical examination as follows:

Paper I: Microbial Biochemistry and Physiology	45 Marks
Papers II: Environmental Microbiology and Biodegradation of wastes and pollutants	45 Marks
Papers III: Agricultural Microbiology	45 Marks
Practical: Including Job Training	65 Marks

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**Total: 200 Marks**

**PAPER I**

**MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY**

**A-Microbial Biochemistry**

**1. Carbohydrates:**

Classification of carbohydrates, optical property, chemical properties of carbohydrates, chemical structure and property of starch, cellulose, glycogens.

**2. Lipids:**

Saturated and unsaturated fatty acids, distribution and functions of lipids in microorganisms.

Degradation of lipids by alpha, beta and omega oxidation, lipid per-oxidation

**3. Enzymes:**

Classification, co-enzyme, cofactor, thermodynamic oxidation of enzyme catalysis, reaction orders, Michaelis-Manton equation, competitive, uncompetitive and non-competitive inhibition, isozymes, factors contributing to catalytic efficiency of enzymes.

**4. Amino acids and Proteins:**

Structure of amino acids, ionization of amino acids and zwitter ionic property, Synthesis of peptides, properties of proteins (acid base property and solubility), Primary, secondary and tertiary structure of proteins.

**5. Oxidation and Reduction Reactions:**

Standard redox potential, Law of Thermodynamics, entropy-enthalpy and free energy of reaction, hydrolysis of energy rich intermediates and ATP.

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**B- Microbial Physiology**

**1. Physiological properties:**

Diffusion, osmosis, plasmolysis, biochemical properties of membranes, passive and active transport.

**2. Photosynthesis:**

Photosynthetic microbes, oxygenic/non-oxygenic reaction centers, photophosphorelation, Calvin cycle (dark reaction), photorespiration and its significance, effect of light, temperature, pH, CO<sub>2</sub> concentration on photosynthesis, measurement of net photosynthetic yield.

**3. Respiratory Pathways:**

Breakdown of carbohydrates through glycolysis, Kreb's cycle, substrate level phosphorelation.

**4. Nitrogen Metabolism:**

Nitrogen fixation in symbiotic and free living system, photosynthetic and non-photosynthetic systems, oxygen and hydrogen regulation of nitrogen fixation, nitrification denitrification and ammonifying bacteria.

**5. Methylootrops:**

Methylogens and Methylootrops, sulphur utilizing bacteria, sulphure production pathways, economic importance of methylootrops and sulphur utilizing bacteria

**PRACTICAL ON PAPER I**

**A. Microbial Biochemistry:**

1. Estimation of glycogen in a bacterial cell
2. Estimation of alkaline phosphatase activity
3. Demonstration of separation of isozymes by polyacrylamide electrophoresis
4. Measurement of Cellulose activity by reducing sugar assay test.

**B. Microbial Physiology:**

1. Demonstration of plasmolysis, osmosis, active and passive transport.
2. Demonstration of evolution of oxygen in light and uptake of oxygen in dark by Photosynthetic microorganisms
3. Demonstration of photosynthetic electron transport by 2-dichlorophenol reduction test
4. Effect of different factors dichlorophenol in dichlorophenol red drop

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**PAPER II**

**ENVIRONMENTAL MICROBIOLOGY AND BIODEGRADATION OF WASTES AND POLLUTANTS**

**A. Environmental Microbiology**

**1. Environment:**

Soil, water and air environment, Microbes and concept of environment, environmental induced genetic and physiological adaptation in microbes, Microbial population of air, water and soil.

**2. Biogeochemical cycle:**

The carbon cycle, Trophic relationship, Microbial mobilization of carbon within the biosphere, the hydrogen and oxygen cycle, The nitrogen cycle, Nitrogen fixation, Ammonification, Nitrification, Denitrification, Nitrite ammonification and sulphure cycle, Use of hydrogen sulphide by autotrophic microorganisms, Amino acid drainage, other element cycle phosphorus, iron.

**3. Population Interaction:**

Neutralism, Commensalism, Synergisms, Mutualism- Microbe-microbe interaction, Plant-Microbe interaction, Animal Microbe interaction, Competition, Amensalism, Parasitism.

**B. Biodegradation of wastes and pollutants**

1. Solid waste disposal. Sanitary landfills. Composting.
2. Treatment of liquid waste- Sewage: Primary treatment, Secondary treatment, Tertiary treatment, Light production.
3. Treatment and safety of water supplies: Disinfection of potable water supplies, Bacterial indicators of water safety, Standards for tolerable of water safety.
4. Biodegradation of environmental pollutants: Alkyl- benzyl sulphonates, Oil Pollution.

**PRACTICAL PAPER – II**

1. Isolation of microorganisms from air.
2. Isolation of microorganisms from soil.
3. Isolation of microorganisms from water.
4. Total count of bacteria from water.
5. Isolation and counting of faecal bacteria from water.
6. Measurement of chloride phosphate and nitrogen in water.
7. Measurement of pathogenic and non-pathogenic bacteria from water sample.
8. Biochemical test for differentiation of different bacteria types from water.
9. Estimation of BOD and COD from water sample.
10. Standard method of water analysis.

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**PAPER – III**

**AGRICULTURE MICROBIOLOGY**

1. Microbiology in relation to: Soil fertility and management of agriculture soils. Influence of available nitrogen of soil fertility, Soil management practices, crop rotation.
2. Elementary idea of Microbial disease of crops, Symptoms of plant diseases and mechanisms of microbial pathogenicity, Transmission of plant pathogens, Viral diseases. Bacterial diseases, Control of crop diseases.
3. Pesticide Microbiology: Biomagnifications, Biodegradation,.
4. Biological Control: General consideration, viral pesticides, Bacterial Pesticides and fungal pesticides.
5. Elementary idea of: Disease of farm animals and control of animal diseases.

**PRACTICAL ON PAPER-III**

1. Measurement of soil pH, temperature, moisture and electrical conductivity and correlation with the microbes.
2. Measurement of total phosphate, nitrate, nitrite and ammonium in soil.
3. Measurement of organic matter in soil.
4. Isolation of fungal phytopathogens from infected plants.
5. Isolation of soil fungi associated with composting for cellulose degradation.
6. Isolation of actinomycetes from soil.
7. Isolation of thermophilic microorganisms from soil.
8. Isolation of free living nitrogen fixer from soil.
9. Demonstration of mycorrhizal association in soil.