NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ENVIRONMENTAL ENGINEERING
SANITARY ENGINEERING PROGRAM

SA323 – SANITARY MICROBIOLOGY I

I. GENERAL INFORMATION

CODE	**:**	SA323 Sanitary Microbiology I
SEMESTER	**:**	4
CREDITS	**:**	5
HOURS PER WEEK	**:**	6 (Theory, Practice, Laboratory)
CONDITION	**:**	Mandatory

II. COURSE DESCRIPTION

The course prepares students in the application of concepts, methods and techniques of microbiology to describe and analyze the biochemical processes of microorganisms, which are relevant concepts in wastewater treatment and waste reuse. Using in-group activities and presentations, student active participation is promoted.

III. COURSE OUTCOMES

At the end of the course, students:

1. Understand the objective of microbiological sciences, as well as the structure and behavior of microorganisms.
2. Understand the process of microorganisms control and the conditions for antimicrobial action.
3. Analyze and carry out microbiological tests of air, water, soil and milk.
4. Apply analysis tests to verify the water quality due to bacterial contents.

IV. LEARNING UNITS

1. INTRODUCTION TO MICROBIOLOGY

Objectives of microbiology / Biology and microbiology / Microorganisms' classification / Microorganisms' study / Areas of microbiology / Applications of microbiology.

2. BACTERIAL STRUCTURE

Form and aggrupation of bacterial cells / Size of bacterial cells / Bacterial structure.

3. ENZYMES

Concept of enzyme / Main types of enzymes / Physical and chemical properties of enzymes / Conditions for enzymatic activities / Inhibition of enzymatic action / Types of enzymatic reactions.

4. METABOLISM

Concept of metabolism / Main types of metabolism / Concepts of respiration and fermentation / Concept of photosynthesis / Energy storage at respiration / Concept of ATP.

5. MICROORGANISMS CONTROL

Terminology used in microbiology / Conditions for antimicrobial action / Action mode / Control by physical procedures / Control by chemical procedures.

6. MICROBIOLOGY OF WATER

Environmental health in water / Microbial flora of natural water / Marine microbiology / Sanitary aspects of water microbiology / Determination of the sanitary quality / Coliform group / Non-coliform microorganisms / Swimming pools.

7. **MICROBIOLOGY OF SOIL**
   Environmental health in soil / Microbial flora of the soil / Conditions for microbial population / Biochemical activity of soil microorganisms / Nitrogen cycles / Carbon and Sulfur.

8. **MICROBIOLOGY OF AIR**
   Environmental health in air / Techniques for microbiologic air analysis / Air microbial contents / Control of air microorganisms.

9. **MICROBIOLOGY OF FOOD**
   Food preservation / Food alteration / Microbiologic analysis of food.

10. **MICROBIOLOGY OF MILK**
    Origin of milk microorganisms / Types of milk microorganisms / Milk microbiologic test / Milk pasteurization

V. PRACTICAL EXPERIENCES

Laboratory 1. Universal distribution of microorganisms.
Laboratory 2. Microscope uses – Bacteria's coloration.
Laboratory 3. Determination of water bacteriological quality.
Laboratory 4. Hydrolysis of starch – Carbohydrates fermentation.
Laboratory 5. Selective bacteriostatic action of the violet crystal – Oligo-dynamic action of heavy metals.
Laboratory 6. Identification of coliform groups.

VI. METHODOLOGY

The course takes place in theory, practice and laboratory sessions. In theory sessions, faculty presents concepts, methods and applications. In practice sessions, various problems are solved and their solution analyzed. In laboratory sessions students carry out experiments to verify microbiological concepts and procedures. At the end of each laboratory experience, students present a report summarizing main findings, results and conclusions. Student's active participation is promoted throughout the course.

VII. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (EP + 2*EF + PL) / 4

EP: Mid-term exam. EF: Final exam.
PL: Average of laboratory and practice works.

VIII. BIBLIOGRAPHY

1. MADIGAN, M. BROCK
   Biology of Microorganisms
   Latin American Publisher, Madrid, Spain.

2. VARMAN, A. & EVANS, M.
   Environmental Microbiology
   Manson Publishing, London, United Kingdom.