NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ENVIRONMENTAL ENGINEERING
SANITARY ENGINEERING PROGRAM

SA445 – WATER TREATMENT I

I. GENERAL INFORMATION

CODE	**:**	SA445 Water Treatment I
SEMESTER	**:**	9
CREDITS	**:**	4
HOURS PER WEEK	**:**	5 (Theory, Practice, Laboratory)
PREREQUISITES	**:**	SA215 Water Supply I
CONDITION	**:**	Mandatory

II. COURSE DESCRIPTION

The course prepares students for the understanding, analysis and design of water treatment plants for human consumption. Water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired end-use. Students identify different types of water treatment plants, understand the principles of coagulation, quick mixing, flocculation and sedimentation, and experimentally determine their most relevant parameters. At the end of the course, students present the design of water treatment process including dosage, quick mixing and flocculators.

III. COURSE OUTCOMES

At the end of the course, students:

1. Identify water contaminants and applicable quality norms.
2. Understand the principles and control parameters of drinkable water treatment: coagulation, quick mixing and sedimentation.
3. filtration and disinfection.
4. Experimentally determine optimal parameters of dosage, flocculation and decantation.
5. Design and integrate all components of a water treatment plant including dosage, quick mixing and flocculators.
6. Assess the performance of water treatment plants.

IV. LEARNING UNITS

1. WATER CONTAMINANTS, WATER QUALITY NORMS

Water impurities. Unit process of water purification. Water quality norms and regulations of the Government Department of Health. Norm OS.20. Manual of the Panamerican Center for Sanitary Engineering and environmental Sciences CEPIS.

2. COAGULATION THEORY. MANAGEMENT OF CHEMICAL COMPOUNDS

Principles of coagulation process. Colloid properties. Coagulation mechanisms. Chemical compounds used in coagulation process. Factors affecting the process. Methodologies for determining dosage parameters. Reception, storage, transferring and dosage of chemical compounds.

3. QUICK MIXING AND FLOCCULATION

Principles of quick mixing. Factors affecting the process. Types of mixing units. Design criteria of quick mixers. Flocculation theory. Factors affecting the process. Experimental determination of flocculation parameters. Types of flocculation units. Flocculators design criteria

4. SEDIMENTATION

Sedimentation principles. Factors affecting the process. Types of sedimentation units. Experimental determination of sedimentation parameters. Laminar sedimentation theory. Design criteria of decantation zone and distribution channels. Design criteria of input and output zones. Design of sludge extraction systems. Sludge storage.

V. LABORATORY EXPERIENCES

1. Laboratory 1. Determination of optimal dosage parameters.
2. Laboratory 2. Determination of flocculation parameters
3. Laboratory 3. Determination of decantation parameters.
4. Study visits to actual water treatment plants.

VI. METHODOLOGY

The course develops through theory, practice, laboratory and study visits sessions. In theory session, the instructor presents the concepts and methods. In practice sessions students, under the guidance of the instructor, apply concept and methods to solve different problems related to water treatment processes, in laboratory sessions students analyze the behavior of flocculation and decantation processes, and the determination of their main parameters. At the end of the course, students complete and present the design of water treatment process including dosage, quick mixing and flocculators. The report is orally defended. Active student participation is encouraged throughput the course.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

$$PF = (EP + 2\,EF + PC) / 4$$

EP: Mid term exam EF: Final exam
PC: Average of quizzes including final report

VIII. BIBLIOGRAPHY

1. **WATER TREATMENT FOR HUMAN CONSUMPTION, VOL 1.**
   Quick Filtering Plants.
   Panamerican Center for Sanitary Engineering and Environmental Sciences CEPIS, 2008
2. **WATER TREATMENT FOR HUMAN CONSUMPTION, VOL 2.**
   Plant Design.
   Panamerican Center for Sanitary Engineering and Environmental Sciences CEPIS, 2008
3. **NATIONAL NORMS AND REGULATIONS – NORM OS.020**
   Water Treatment Plants for Human Consumption.
   Government Department of Health.