NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ENVIRONMENTAL ENGINEERING
SANITARY ENGINEERING PROGRAM

SA245 – SEWER AND FLUVIAL DRAINAGE

I. GENERAL INFORMATION

CODE	**:**	SA245 Sewer and Fluvial Drainage
SEMESTER	**:**	9
CREDITS	**:**	4
HOURS PER WEEK	**:**	6 (Theory, Practice, Laboratory)
PREREQUISITES	**:**	SA215 Water Supply I
CONDITION	**:**	Mandatory

II. COURSE DESCRIPTION

The course prepares students for the analysis and design of sewerage networks and drainage systems for satisfying requirements in different regions of the country. The course is divided in two parts: fluvial water and residual water. Students design fluvial water drainage systems taking into account rain intensity and frequency, flooding, and their evacuation. Students design sewerage network systems applying norms and regulations pointing to avert the propagation of hydric diseases. Students complete the design work, and technical and economic feasibility studies for completing a file following the requirements of government public investment projects.

III. COURSE OUTCOMES

At the end of the course, students:

1. Understand and apply the concepts and methods of sewerage systems and fluvial drainage.
2. Explain the difference and characteristics of fluvial water and residual water.
3. Determine de present and future requirements of sewerage systems for a given population.
4. Specify and select the pumping system of a sewerage network and fluvial drainage system.
5. Design sewerage networks and complete the file according to Government requirements.
6. Understand the process of operation and maintenance of sewerage and fluvial drainage systems.
7. Fulfill safety and quality norms and regulations.

IV. LEARNING UNITS

1. INTRODUCTION

History of sewer in the world. Development of sewer systems in main world cities. Submission of sewer proposal to Government authorities. Feasibility of sewer network projects.

2. TYPES OF SEWER SYSTEMS

Domestic and fluvial sewerage recollection systems. Separated systems. Combined systems. Design considering flows of domestic and fluvial sewerage. Required data and information for formulating a sewerage system project. Roadmaps.

3. RESIDUAL WATER

Characterization of residual water. Bacteriological characteristics. Physical and chemical characteristics. Gases concentration. Longitudinal flange profile.

4. POPULATION

Estimation and projection of population size in a district, a city, a county, a region using statistical methods and tendencies.

5. SEWERAGE NETWORKS

Components of a sewerage system: hydraulics, collectors, channels. Load losses. Tractive tension. Specific energy. Froude number. Demand projection.

6. SEWERAGE NETWORKS PROJECT

Steps to formulate a sewerage network project in a district, a city and a county. Norms and regulations. Service feasibility. Technical and economic feasibility.Requisites and components of a sewerage project. Design period. Complementary studies. Hydraulic computations.

7. PUMPING CHAMBER

Design of sewerage pumping chamber. Location. Selection of pumping equipment. Flow and pressure calculations.

8. INVERTED SIPHON

Principle of inverted siphon. Minimum number of pipes. Aspects to be taken into account when designing an inverted siphon system.

9. FINAL LAYOUT AND DISTRIBUTION

Geological considerations. Transport and final layout. Discharges. Treatment plant. Undersea discharging pipe.

10. OPERATION AND MAINTENANCE

Operation and maintenance of sewerage systems. Classification of operations and activities. Common abnormalities. Removal of obstructions. Preventive, corrective and predictive maintenance.

11. STORM WATER AND RUNOFF

Fluvial water, rains, intensity, frequency, storms. Flood flows. Rain intensity measurement. Flood flows analysis. Runoff. Calculation of runoff coefficient according to land type. Design of fluvial drainage networks.

V. METHODOLOGY

The course develops through theory, practice, and design workshop sessions. In theory session, the instructor presents the concepts and methods. In practice sessions, students apply concepts and methods to solve different problems related to sewerage and fluvial drainage. In design workshop sessions, students complete the design of a sewerage system for a city in different regions of the country. At the end of the course, students present and defend the design report. Active student participation is encouraged throughput the course.

VI. EVALUATION FORMULA

The average grade PF is calculated as follows:

PF = (2 EP + 3 EF + 3 PC) / 8

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

VII. BIBLIOGRAPHY

1. **FLUID MECHANICS AND HYDRAULICS**
   Ronald Giles
   McGraw Hill Editions, USA

2. **DESIGN OF AQUEDUCTS AND SEWERAGE SYSTEMS**
   Ricardo Cuallla
   Alfa-Omega Editions, Spain.