



## **PIPELINE DESIGN, MAINTENANCE AND REHABILITATION PRACTICES**

### **5-Day Training Program**

#### **INTRODUCTION**

We all take pipes for granted and do not think how these are designed installed and maintained. This course is intended to highlight the methods used in pipeline design and also will look into the procedures used for maintaining and rehabilitating pipelines, concentrating on Sewers. The course will also look at the analysis of pipe networks and various phenomena within pipelines.

#### **OBJECTIVES**

Having attended the course delegates will understand how to;

- ❖ Design pipelines
- ❖ Understand the rehabilitation Procedure for pipes & Analyze pipe networks
- ❖ Understand the causes of Water Hammer in Pipes

#### **LEARNING OUTCOMES**

After studying this course, attendees should be able to:

- ❖ Understand the major aspects pipe design and maintenance
- ❖ Be able to identify the main steps taken in a pipe rehabilitation procedure
- ❖ Understand pumps
- ❖ Undertake a pipeline and pump design
- ❖ Understand the Water Hammer in pipes and their effects



## PROGRAM

### DAY ONE

#### Fluid Properties

- Chemical
- Physical

#### Fluids in Motion

- Types of flow
- Continuity of Flow
- Energy of a flowing fluid
- Momentum of a flowing fluid

#### Flow Measurements Through Pipes

- Venturi meter
- Orifice meter
- Pitot tube

#### Energy Losses in Pipelines

- Minor & Major losses

#### Friction Losses in Pipelines

#### Hydraulic Gradient

### DAY TWO

#### Design of Gravity pipelines

#### Use of Moody's Diagram

#### Use of Hydraulics Research Stations Tables



## Use of Resistance Equations

## Design of Gravity Sewer (Tutorial)

### DAY THREE

#### Sewerage Rehabilitation Manual

- Phase I
- Phase II
- Phase III
- Phase IV

#### Water Mains

- Operation and Maintenance
- Rehabilitation
- Pipes, Valves and Meters

#### Sewage Storm Overflows

##### Purpose

##### Types

#### Flow Regulators

- Types

### DAY FOUR

#### Pumps

- Types
- Pump Head
- Multiple Pump Systems
- Pumping Calculation Tutorial

#### Cavitation

- Definition
- Theory
- Examples



## DAY FIVE

### Unsteady Flow in Pipes (Water Hammer)

- Pressure Propagation in pipes
- Theory
- Examples

### Pipe Network analysis

- Conditions for the analysis
- Methods
- Examples