

# PIPELINE DESIGN, MAINTENANCE AND REHABILITATION PRACTICES

## 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 & Analyse 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

## PRESENTER

**Dr. Rafid Alkhaddar BSc MSc PhD CEng FCIWEM ILTM**

Dr. Alkhaddar has extensive experience in Water Engineering, with special expertise in Wastewater Treatment methods, which include Pipeline design and Maintenance. In his position as a Reader in Water Engineering at Liverpool John Moores University, he has organised and delivered a number of course related to Water and pipeline Engineering. He is also the programme leader for the innovative MSc in Water, Energy and the Environment which is based on collaboration with the Chartered Institution of Water and Environmental Management (CIWEM), the Leading British Institution of all aspects related to water and environmental issues. The overall aim is to achieve an academic qualification from the University as well as a professional qualifications from the Institution.

## 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