Oil and Gas Pipeline Design, Maintenance and Repair

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Course Description
BASIC INFORMATION

Title: Oil and Gas Pipeline Design, Maintenance and Repair
Code: PE 607
Credit Hrs.
   Lectures: 2
   Tutorial: 0
   Practical: 0
   Total: 2
PROFISSIONAL INFORMATION

1. OVERALL AIMS OF COURSE
2. INTENDED LEARNING OUTCOMES (ILOs)
3. CONTENTS
4. TEACHING AND LEARNING METHODS
5. STUDENT ASSESSMENT METHODS
6. LIST OF REFERENCES
7. COURSE COORDINATOR
1. COURSE OBJECTIVES

• Expand the scope of the petroleum engineer to include the importance pipeline materials and components.
• Include fluid flow through pipes, pipeline materials and components, the loads the stresses applied on the pipeline, the design procedures of oil and gas pipeline.
• Pipeline locations and the hazards associated with each type, the pigging technique to clean the pipeline, leak detection, pipeline repair procedures
• Corrosion process and the protection measures, the pipeline network and the design procedures and pipeline design case study and the feasibility measures
2. INTENDED LEARNING OUTCOMES (ILO’s)

a. Knowledge and Understanding
   – Pipeline manufacturing, Materials, Fittings, Installation and Construction
   – Measuring instrumentation and leak detection
   – Pipeline maintenance and repair
   – Pipeline network and pigging

b. Intellectual Skills
   – Thinking skills for design analysis
   – Systemic skills for material selection
   – Creative thinking for water hammer and cavitation detection
   – Creative thinking for safety system analysis and pig selection
2. INTENDED LEARNING OUTCOMES (ILO’s)

c. Professional Skills
   – Design calculation
   – Inspection methods
   – Pipeline protection
   – Case study procedures

d. General and Transferable Skills
   – Operation reporting
   – Hazard awareness
   – Computer application
## 3. CONTENTS

<table>
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<th>Contents</th>
<th>Lectures</th>
<th>Lab/Tutorial</th>
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<td>Part 2: Single phase Incompressible flow of Newtonian Single</td>
<td>8</td>
<td>2</td>
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<tr>
<td>Part 3: Phase Incompressible Flow of Newtonian</td>
<td>8</td>
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<td>Part 4: Pipeline Components</td>
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<tr>
<td>Part 5: Design of Pipelines</td>
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<td>Part 6: Planning and Construction of Pipelines</td>
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<tr>
<td>Part 7: Instrumentation and Pigging</td>
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<td>Part 8: Pipeline maintenance</td>
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<td>Part 9: Pipeline defects</td>
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<td>Part 10: Corrosion in pipeline</td>
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<tr>
<td>Party 11: Pipeline rehabilitation</td>
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<tr>
<td>Part 12: Leak detection and SCADA system</td>
<td>4</td>
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<tr>
<td>Part 13: Risk assessment</td>
<td>2</td>
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4. TEACHING AND LEARNING METHODS

4.1 Lectures, including slide show and power point presentations
4.2 Case studies ended by discussions
4.3 Tutorial and Practice classes for problems answer.
4.4 Laboratory work and reports
## 5. STUDENT ASSESSMENT METHODS

<table>
<thead>
<tr>
<th></th>
<th>Assessment</th>
<th>Skill</th>
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</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Attendance</td>
<td>Assess willingness to learn</td>
</tr>
<tr>
<td>5.2</td>
<td>Assignment</td>
<td>Assess knowledge and understanding</td>
</tr>
<tr>
<td>5.3</td>
<td>Case Study</td>
<td>Assess intellectual and professional skills</td>
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<tr>
<td>5.4</td>
<td>Presentation</td>
<td>Assess group work and communication skills</td>
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<tr>
<td>5.5</td>
<td>Midterm Exam</td>
<td>Assess practical, general and transferable skills</td>
</tr>
<tr>
<td>5.6</td>
<td>Final exam</td>
<td>Assess Most of the skills</td>
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# Assessment schedule

<table>
<thead>
<tr>
<th>Assessment No.</th>
<th>Assessment Type</th>
<th>Time</th>
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<tbody>
<tr>
<td>Assessment 5.1</td>
<td>Attendance</td>
<td>Weekly</td>
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<td>Assessment 5.2</td>
<td>Assignment</td>
<td>Biweekly</td>
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<td>Assessment 5.3</td>
<td>Case Study</td>
<td>Week 10</td>
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<tr>
<td>Assessment 5.4</td>
<td>Presentation</td>
<td>Week 15</td>
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<tr>
<td>Assessment 5.5</td>
<td>Midterm Exam</td>
<td>Week 12</td>
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<td>Assessment 5.6</td>
<td>Final exam</td>
<td>Week 30</td>
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# Weighting of Assessment

<table>
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<tr>
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<tr>
<td>Assessment 5.2</td>
<td>Assignment</td>
<td>5</td>
</tr>
<tr>
<td>Assessment 5.3</td>
<td>Case Study</td>
<td>5</td>
</tr>
<tr>
<td>Assessment 5.4</td>
<td>Presentation</td>
<td>5</td>
</tr>
<tr>
<td>Assessment 5.5</td>
<td>Midterm Exam</td>
<td>20</td>
</tr>
<tr>
<td>Assessment 5.6</td>
<td>Final exam</td>
<td>60</td>
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<tr>
<td>Total assessments</td>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
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6. LIST OF REFERENCES

6.1 Course Notes

– Course notes will be handed to the students or downloaded from the website

6.2 Essential Books

6. LIST OF REFERENCES

6.3 Recommended Books
- Frankland, Thomas W., The Pipe Fitter’s and Pipe Welder’s Handbook, 1999
- Graves, W.V., The Pipe Fitters Blue Handbook,
- Peabody, A.W., Control of Pipeline Corrosion

6.4 Periodicals, Web Sites, ... etc.

6.5 Selected Software
- Pipeline Toolbox (Enterprise Edition) www.technical
toolboxes.com/software/pipeline_enterprise.htm,
7. COURSE COORDINATOR

Prof. Dr. Abdel-Alim Hashem
Date: 2/15/2006
QUESTIONS
Oil & Gas Pipeline Design, Maintenance & Repair

**REYNOLD’S NUMBER OF FLOW IN CUSTOMARY UNITS**

\[
R_e = 0.5134 \left( \frac{\gamma_g q}{P_b \mu_d} \right)
\]

- \( R_e \): Reynolds number
- \( P_b \): base pressure, kPa
- \( \mu_d \): dynamic viscosity of gas, \( \text{cP} \)
- \( \gamma_g \): specific gravity of gas (air = 1.0)
- \( q \): gas flow rate, standard. units

**FLOW EQUATIONS FOR HIGH PRESSURE SYSTEM**

**General**

Keywords: Inspection and maintenance; oil & gas pipelines; maintenance policies; time-based.

16. maintenance; condition based maintenance; risk-based maintenance.

Oil and gas (O&G) pipelines are expensive assets that cross through both ecologically sensitive and densely populated urban areas. Apart from static design approach, reliability based design approach is adopted in oil and gas pipeline design. Pipeline Design, Operation and Maintenance Standards

23. Codes and Specifications

23. List of Organizations involved in the Generation and Publication of Pipeline Codes and Standards

24. Major Codes and Standards Governing the Design, operation and Maintenance of Pipeline

26. Development of Codes and Standards

1.1 Pipeline Basics and Factors Influencing Pipeline Design.

Pipelines play a vital role in the transmission of oil and gas from the source to the destination for further refining, processing and storage. Most of developed countries have an extensive pipeline network that help meet energy and product demands at different locations. Pipeline construction and use is increasing at a rapid pace in developing nations. Testing and maintenance & emergency repair technology. Equipment and products. Pipeline leakage control and recovery machine

Heat shrinkable sleeve infrared heater Pipeline automatic polyurea spray machine Pipeline defect carbon fiber composite recovery material Heating furnace Station skid-mounted units Fittings Pipeline ch.

CNPC not only has powerful design and construction technologies for oil and gas pipeline and tank (depot), but also possesses the national Grade A qualification of comprehensive engineering design and special grade qualification of general contract for chemical and petroleum engineering construction; as well as specialist teams composed of national survey masters, design masters and the specialists who enjoy the special.
The current natural gas pipeline boom gives many homeowners a first row seat to the process of pipeline construction. The rush to move natural gas to markets places pipelines too close to homes, with construction taking place in backyards, farms, pastures, and right at the mailboxes of residents throughout the country. This page walks you through the process of a natural gas pipeline currently being constructed. Getting started: After all federal and state level permits are approved and easement agreements or eminent domain condemnations completed, the process of pipeline construction can begin.

Pipeline - Pipeline - Oil pipelines: There are two types of oil pipeline: crude oil pipeline and product pipeline. While the former carries crude oil to refineries, the latter transports refined products such as gasoline, kerosene, jet fuel, and heating oil from refineries to the market. Different grades of crude oil or different refined products are usually transported through the same pipeline in different batches.

The construction of an offshore gas pipeline in the North Sea. Contunico © ZDF Enterprises GmbH, Mainz See all videos for this article. Offshore (submarine) pipelines are needed for transporting oil and natural gas from offshore oil wells and gas wells to overland pipelines, which further transport the oil to a refinery or the gas to a processing plant. Oil & Gas Pipeline Design, Maintenance & Repair

REYNOLD'S NUMBER OF FLOW IN CUSTOMARY UNITS

\[
\text{Re} = \frac{\rho q D}{\mu} 
\]

\[\text{Re} = \frac{\text{velocity} \times \text{diameter}}{\text{viscosity}}\]

\[
\text{\(\rho\)} = \text{base pressure}, \text{kPa} \quad \text{\(T_b\)} = \text{base temperature}, \text{ÂºK (273 + ÂºC)} \quad \text{\(\gamma_g\)} = \text{specific gravity of gas (air = 1.0)} \quad \text{\(\mu_d\)} = \text{gas flow rate, standard}. \]

PE 607: Oil & Gas Pipeline Design, Maintenance & Repair FLOW EQUATIONS FOR HIGH PRESSURE SYSTEM

General 15. Keywords: Inspection and maintenance; oil & gas pipelines; maintenance policies; time-based. 16. maintenance; condition based maintenance; risk-based maintenance. Oil and gas (O&G) pipelines are expensive assets that cross through both ecologically sensitive and densely populated urban areas. Apart from static design approach, reliability based design approach is adopted in oil and gas pipeline design.