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MOE103

Inspection & Maintenance of Subsea Pipelines & Offshore Structures

Course Introduction:

The course will provide a complete and up-to-date overview of the area of the marine pipeline engineering, taking delegates through the pre-design phase, design, construction, installation, operation and maintenance. It will give a complete picture of the work of design engineers and pipeline construction companies, using actual case studies from around the world to highlight the topics discussed.

The course does not require previous experience of marine pipelines, this is not a superficial overview, and it goes into detail about current thinking and recent developments.

Course Objectives:

Upon successful completion of this course, the delegates will be able to:

- ✓ Apply and gain an in-depth knowledge on subsea pipeline engineering
- ✓ Differentiate the internal corrosion, external corrosion and coatings as well as the significance of cathodic protection
- ✓ Employ the proper method of shore approaches and describe the design for stability
- ✓ Discuss marine pipeline construction, route selection, hydraulics and flow assurance
- ✓ Explain the design for strength as well as insulation and temperature control
- ✓ Demonstrate the design exercise including pipeline configuration, diameter and route selection
- ✓ Evaluate the design exercise and conclusion and discuss welding and decommissioning including pipeline construction

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Who Should Attend?

This course intended for Engineers from oil and gas companies, construction companies, pipe and service suppliers and regulatory authorities with responsibility for, or interest in, subsea pipeline design, construction, inspection, maintenance and repair. Those who are newly qualified, have recently moved into pipeline engineering, or hold broad responsibilities that include pipelines will also find the course of great value.

Course Outline:

Day 1:

- **Design Overview and introduction to marine pipeline construction**
  - Introduction to design sequence and its interaction with the different topics covered in the course
  - Film on construction and connection of an offshore pipeline

- **Route Selection**
  - Principles of route selection
  - Constraints imposed by oceanographic, geotechnical, environmental, safety and political factors
- **Introduction to Design Exercise**
- **Design Exercise Phase 1**
  - Configuration and route selection
- **Presentation of Conclusions of Phase 1 of Design Exercise**
  - Participants present their choices of route
- **Marine Environment**
  - Waves; currents: tide, storm surge, loop currents; seabed geotechnics; biology
- **Carbon Steel Line Pipe**
  - Fabrication of API pipe
  - Increasing the strength of pipeline steel
  - Balancing strength, toughness and weld ability

Day 2:

- **Increasing Corrosion Resistance**
  - Increasing the corrosion resistance of carbon steels
  - Limitations of use of solid corrosion resistant alloys
  - Internally clad pipe
  - Flexible pipe
- **Design for Stability**
  - Hydrodynamic forces in steady and unsteady flow
  - Lateral resistance
  - Interaction with seabed instability
- **Spans**
  - Description of span occurrence
  - Need not to exaggerate problem
  - Analysis: vortex-induced vibration, overstress, hooking
  - Span monitoring and correction
- **Hydraulics and Flow Assurance**
  - Single-phase flow, oil and gas
  - Calculation of pressure drop and effect on optimal line in size
  - Influence of compressibility, temperature change and profile, two phase flow
  - Flow regimes, correlations, profile effects, terrain-induced slugging, slugging in risers
  - Hydrates and wax
- **Materials for Sour Service**
  - Pipeline steels for sour service: sulfide stress cracking and HIC
  - Appropriate specification of pipe material

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- **Design for Strength**
  - Internal pressure, code requirements
  - External pressure; bending; bending buckling; collapse and buckle propagation; denting and gouging; allowable strain design; impact damage

Day 3:

- **External Corrosion and Coatings**
  - Coating for submarine pipeline: enamels, FBE, triple coats, extruded coatings and elastomers.
  - Inspection of coating integrity
  - Field joints
- **Cathodic Protection**
  - Conjoint protection by coating and cathodic protection
  - Mechanism of CP
  - Design of sacrificial anode systems
  - Thermal effects on CP performance
  - Interactions between CP Systems
- **Lateral and Upheaval Buckling**
  - Upheaval buckling onshore; driving force; analysis
  - Alternative approaches to control of upheaval
  - Case study of upheaval buckling
  - Ongoing studies
- **Pipe laying**
  - Alternative construction techniques
  - Lay barge S-Lay and J-Lay
  - Reeling
  - Surface, mid-depth and bottom tow
  - Videos illustrating alternatives
- **Codes**
  - Historical background
  - Use and misuse of codes
  - Alternative approaches to codes
  - Limit states
  - Code calibration

Day 4:

- **Microbiological Corrosion**
  - Sulphate-reducing bacteria
  - Microbiological corrosion mechanisms
  - Evaluation of the severity of the problem

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- Housekeeping and treatment

- **Design Exercise Phase 2**
- **Conclusions of Design Exercise**
  - Participants present their designs
  - The lecturers critique the participants' design, support the discussion with additional calculations
- **Mishaps, Risk and Repair**
  - Safety of marine pipeline systems
  - Reliability analysis
  - Case studies of failures and subsequent repairs, Integrity management

Day 5:

- **Monitoring and Inspection**
  - Inspection before and during installation and commissioning
  - Inspection in service
  - Intelligent pigging
  - Corrosion monitoring
  - Analysis of corrosion monitoring data
- **Trenching and Burial**
  - Reasons for trenching and burial
  - Alternatives: jetting, cutting, and ploughing
- **Welding**
  - Welding of carbon manganese pipeline steels
  - Welding of duplex and clad pipe
  - Inspection of welds
- **Decommissioning**
  - Legal, environmental and financial background
  - Legislations
  - Decay mechanisms
  - Alternative strategies: stabilization, recovery, re-use
- **Current and Future Developments**
  - Progress in marine pipelines: new concepts, materials, construction techniques, weld methods

Course Certificate:

International Center for Training & Development (**ICTD**) will award an internationally recognized certificate(s) for each delegate on completion of training.

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Course Fees:

To be advised as per the course location. This rate includes participant's manual, Hand-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Methodology:

A variety of methodologies will be used during the course that includes:

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionaires
- Group Work
- Discussion
- Presentation

Course Timings:

Daily Course Timings:

08:00 - 08:20	Morning Coffee/Tea
08:20 - 10:00	First Session
10:00 - 10:20	Coffee/Tea/Snacks
10:20 - 12:20	Second Session
12:20 - 13:30	Coffee/Tea/Snacks
13:30 - 15:00	Last Session

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