

## Maintenance and Integrity of Offshore Structures

### Course Focus: Ultrasonic Peening, Fatigue Inspection & Life Extension

#### COURSE OVERVIEW

This course provides engineers, inspectors, and asset managers with an advanced understanding of how maintenance strategies, ultrasonic peening, and inspection programs work together to extend the operational life of offshore assets.

Participants learn to identify fatigue-prone details, evaluate condition, apply modern peening technologies, quantify life extension, and integrate these practices into a risk-based maintenance strategy.

#### TARGET AUDIENCE

This course is designed for professionals involved in the design, operation, inspection, and life extension of offshore and marine structures, including:

- Structural and offshore engineers
- Asset integrity and maintenance engineers
- Inspection engineers and NDT specialists
- Asset managers and technical authorities
- Engineering consultants and project managers working with ageing offshore assets
- Operators and contractors involved in life extension, brownfield modifications, and sustainability initiatives

#### REQUIRED QUALIFICATIONS / BACKGROUND

Participants are expected to have:

- A technical background in engineering or a related discipline (structural, mechanical, materials, or offshore engineering preferred)
- Basic understanding of offshore structures, welding, and inspection practices
- Familiarity with fatigue, corrosion, or asset integrity concepts is beneficial but not mandatory

The course is suitable for both experienced professionals seeking deeper technical insight and early-career engineers aiming to build competence in fatigue management and life extension.

#### COURSE DURATION & FORMAT

Duration: 3 days

Format:

- Instructor-led training (classroom or virtual)
- Combination of lectures, technical discussions, and case studies
- Optional practical demonstration or workshop on ultrasonic peening

Typical daily duration: approximately 6–7 hours per day.

## DAY 1 — Offshore Structural Integrity & Fatigue Management

### 1. Offshore Structure Integrity Fundamentals

- Offshore structure types
- Environmental loads
- Corrosion & degradation mechanisms
- Interaction between corrosion protection and fatigue

### 2. Fatigue Damage Mechanisms

- Stress concentration at welded joints
- Crack initiation vs. propagation
- S-N curves
- Fatigue-critical structural details

### 3. Regulatory & Integrity Frameworks

- DNV-ST-F101, DNV-RP-C203, API RP 2A, ISO 19900
- Inspection requirements
- Fitness-for-Service methods

### 4. Case Studies of Offshore Fatigue Failures

## DAY 2 — Ultrasonic Peening & Advanced Inspection Techniques

### 1. Maintenance Methods for Fatigue Life Enhancement

- Grinding, TIG dressing, shot peening
- Ultrasonic Impact Treatment (UPT)

### 2. Ultrasonic Peening Principles & Mechanisms

- Ultrasonic vibration process
- Residual stress improvement
- Microstructure refinement

### 3. Ultrasonic Peening in Offshore Applications

- New vs. in-service welds
- Life extension factors

- Application challenges
- Integration with corrosion protection

#### 4. Inspection Techniques Before and After Peening

- MPI, UT, phased array, TOFD
- Toe radius measurement
- Residual stress confirmation
- Documentation and reporting

#### 5. Practical Demonstration / Workshop (optional)

### DAY 3 — Life Extension, Risk-Based Maintenance & Asset Management

#### 1. Engineering Assessment for Life Extension

- RUL calculations
- Fracture mechanics
- Updated S-N curves
- Reliability assessment

#### 2. Integrity Management & Inspection Planning

- Condition-based maintenance
- Risk-Based Inspection (RBI)
- Digital twins and monitoring

#### 3. Life Extension Strategies

- Treatment vs. repair vs. replacement
- Economic considerations
- Multi-year asset integrity planning

#### 4. Sustainability & Carbon Footprint Reduction

- Reduced material replacement
- CO<sub>2</sub> savings
- ESG alignment

#### 5. Case Studies & Group Exercises



life extension of technical structures

## LEARNING OUTCOMES

- Identify fatigue-critical areas in offshore structures
- Select appropriate inspection methods
- Understand the mechanisms and benefits of ultrasonic peening
- Perform fatigue life extension assessments
- Develop inspection and repair strategies
- Quantify environmental benefits of life extension