



# Fundamentals Of Mechanical Engineering

Training Program



## Introduction:

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Process engineering is at the heart of much of the chemical, oil, gas, and petrochemical industries. It requires familiarity not only with chemical engineering principles, but also with many of the other engineering disciplines including electrical and instrumentation, but especially mechanical. The process engineer is interested in the transportation and transformation of solids, liquids and gases. Of specific importance are separation processes including distillation, heat transfer, hydraulics and fluid flow, reaction engineering, but also process control and economics.

The mechanical engineer is interested in safe containment and movement of solids, liquids and gases, often at high temperature and pressure. Of specific importance are failure modes such as fracture, fatigue and creep, corrosion and corrosion minimization, material properties, design standards, static and rotating equipment design, inspection and repair as well as an understanding of maintenance strategies and condition monitoring. Sound mechanical engineering principles, together with other engineering techniques including inspection, monitoring and condition evaluation, enable the mechanical engineer to design and maintain the equipment required by the process engineers.

## Who Should Attend?

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Mechanical Engineers, General Supervisors, Consulting Engineers, Design Engineers, Foremen, Supervisors, Technicians, Maintenance Personnel, Engineers of all disciplines, Supervisors, Team Leaders and Professionals in Maintenance, Engineering and Production Managers, Maintenance Personnel, Heads of Maintenance and Operation, Chemical Engineers, Equipment Specialists, Technical Engineers, Operation Engineers, Planning Engineers, Process Engineers, Reliability Specialists, Boiler Plant Construction Managers, Consulting Engineers, Design Engineers, Insurance Company

Inspectors, Operation, Maintenance, Inspection and Repair Managers, Supervisors and Engineers, Plant Engineers, Senior Boiler Plant Operators, Repairers and Installers, all technical and nontechnical personnel in the chemical, petrochemical, oil and process and mechanical industries, Petroleum Engineers, Production Engineers, Maintenance and Project Engineers, Trainee Mechanical Engineers, Trainee Process Engineers, Plant Chemists, Plant Operators and Economists

## Course Objectives:

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**By the end of this course, delegates will be able to:**

- Develop both fundamental and practical understanding of central issues in processes used in oil, gas, petrochemical, chemical, and allied facilities together with a practical understanding of central issues in mechanical engineering as applied in those industries
- Understand the various static and rotating equipment used in the petrochemical environment.
- Apply different maintenance strategies and philosophies
- easily identify and assess active degradation of mechanisms and the failures they may cause
- Enhance their competencies in mechanical design of pressure equipment and piping systems in compliance with applicable codes, standards, and regulations

## Course Outline:

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### **Introduction and Fundamentals: Engineering Material Properties**

- Stress and strain
- Fracture failure, modes
- Stress concentration

- Fracture toughness
- Fatigue failure, testing and mechanism
- Temperature considerations and creep failure
- Identification of damage mechanisms

### **Mechanical Design**

- Codes and standards
- Design for static strength

### **Materials Selection and Inspection**

- Materials selection
- Materials of construction
- Carbon steels
- Alloy steels
- Stainless steels
- Nickel based and titanium alloys

### **Inspection techniques**

- Visual
- Penetrant
- Magnetic flux
- Eddy current inspections
- XRay and Gamma ray
- Ultrasonics TOFD and PulseEcho

### **Valves, Piping and Fitness for Service**

- Valves
- Valve types

- Valve characteristics
- Valve applications
- Valve selection
- Valve actuators
- Piping and pipelines

### **Pipe Types, Construction and Schedules**

- Steel pipes
- Welded types and sections
- Flanges and gaskets
- Plastic pipes, composite pipes
- Pipe coatings and linings
- Pipe supports and insulation blocks
- Stress relief in piping design
- Pigging
- Water hammer
- Inspection and repair of pipelines and piping
- Fitness for service

### **Corrosion**

- Corrosion fundamentals
- Types of corrosion
- Corrosion inspection and monitoring
- Corrosion minimization
- Coatings
- Inhibitors
- Cathodic protection

## **Compressors**

- Types of compressors reciprocating, centrifugal and screw
- Blading and staging
- Performance curves
- Compressed air usage and instruments
- Glands and mechanical seals

## **Mechanical Maintenance**

- Strategies and philosophies
- Maintenance system optimization
- Maintenance management systems
- Condition monitoring
- Vibration analysis
- Shaft alignment