

# **COURSES MODULE**

## **For**

# **MECHANICAL EQUIPMENT DESIGN ENGINEERING**



### Course Outline

- ❖ Overview of Industry and role of Equipment Designer in various Fields.
- ❖ Basic Design requirement based on the type of Plant/Project.
- ❖ Overview of PFD, P&ID and Process Data Sheets.
- ❖ Mechanical design of Process Equipments. (Vessels, Reactors, Heat Exchangers, Distillation Columns, Chimney, etc.)
- ❖ Preparation of G.A. Drawings and Fabrication drawings of Equipments.
- ❖ Overview of Rotary Equipments.
- ❖ Overview of Piping/Nozzle Orientation/Isometric etc.
- ❖ Basic Information about Welding, Inspection & Testing.
- ❖ Inputs required and use of the inputs.
- ❖ Relevant Codes & Standards used in Industry.
- ❖ Material Inspection.
- ❖ Use of vendor data while designing of equipments.
- ❖ Checking of Vendor data.
- ❖ Interview Preparation and Mock Interviews. Module Details

### Who Will Attend

- ❖ Mechanical Engineers, Chemical Engineers responsible for pressure vessel / STATIC process equipment design & engineering.
- ❖ STATIC Equipment Design Engineers / Process Engineers / Inspection Engineers / Fabrication Engineers.
- ❖ Fresh Engineering Graduates aiming to work for EPC / Plant Owner Companies as Equipment Design Engineers.

# Mechanical Equipment Design & Detail Engineering

## Basic Engineering Package

Overview of Industry and role of Mechanical Design Engineer in various Fields.

Basic Design requirement based on the type of Plant/Project.

Overview of PFD, P&ID and Mechanical Datasheet.

Relevant Codes and Standards used in Industry.

Preparation of mechanical equipment specification.

Basic Information about Welding, Inspection & Testing.

## Material Engineering

Introduction of metallurgy, review of engineering properties, stress-strain diagrams.

Factors governing choice of materials, criteria for material selection for process equipment.

Commonly used carbon steels / stainless steels / alloy steels

Choice of materials for low temperatures / high temperatures, corrosive service.

Gasket materials, non metallic material etc.

Painting and coating for corrosion protection, surface preparation, pickling & passivation.

## Rotating Equipment Design

Introduction of Rotary Equipments.

Selection

Sizing

Detailed engineering of rotating equipment such as Turbines, Compressors, Pumps and Fans.

## Static Equipments Design

### - **Column & Tower Internals**

Types of Internals

Functions of Internals

Process aspect of these internals

Specialized manufacturers of internals.

Scope and design of the internals

### - **Storage Tanks**

Classification of storage tanks – bulk storage and day storage, sizing & optimization, Design of tank components as per codes & standards, bottom plate layout & testing.

Shell design by one foot-method, conical roof & dome roofs, basic considerations in design of floating roofs, design for wind girders / stiffness, nozzles and accessories.

Inspection & testing.

### - **Pressure Vessel/Column/Reactor Design Calculation: (ASME SEC VIII, DIV.1)**

Material Technology related to Pressure Vessel Design and Engineering

Maximum Allowable Stress Values (UG-23)

Shell Design for Internal Pressure (UG-16, UG-27, Appendix 1-2)

Dished End Design For Internal Pressure ( UG-32)

Shell Design for External Pressure (UG-28, UG-29, UG-30) Dished

End Design For External Pressure ( UG-33)

Hydrotest Pressure/Pneumatic Test (UG-99,UG-100) Wind Load ( IS-875, Pt-3)

Seismic Load ( IS-1893, Pt-1 & 4) Combined Loading Effect

Conical & Toriconical Section Analysis (UG-32, 33, Appendix 1-5 & 1-8) Weight Calculation

Opening (Nozzles) ( UG-36 ~ UG-45 & Appendix 1-7) Local Load ( WRC 107 & 297)

MDMT & Impact Test Enigma (UCS-66) Lifting & Tailing Lug analysis

Support Analysis (Skirt, Leg, Saddle )

Joint Efficiency, MAWP, MAP, SR of DE for Forming Operation PWHT ( UCS-56)

### - **Design & Analysis of Heat Exchangers**

Heat exchanger types, classification, categories and nomenclatures as per TEMA Geometrical Configuration as per TEMA & Int. Stds.

Design of Shell, Channel, Shell Bonnet , Channel Cover , Selection of Girth Flanges.

Limitations in the use of heat exchangers.

Components of Heat Exchangers

Design aspects in the design of Heat Exchangers.

Tube sheet Design: Fixed Tube sheet , Floating Tube sheet , U – Tube sheet

Design of tube sheet as per TEMA as per Bending and Shear Loading.

Limiting cases in the design of heat exchangers.

Testing of Heat Exchangers

Introduction to the following types of heat exchangers:

- Condensers
- Evaporators
- Reboilers
- Plate Heat Exchangers

Mechanical Design as per TEMA & UHX (ASME)

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