

**Course Content****Title:** Mechanical Engineering Training**Potential PDH:** 40**Code:** BTT003**Description:**

This 5-Day Mechanical Engineering training will encompass the following topics:

**Outline:**

- 1.Introduction
- 2.Objectives
  - 2.1.Overview of course material
- 3.Introduction to Codes & Standards
  - 3.1.ASME Pressure Vessel Code, Section VIII Division 1 and 2
  - 3.2.ASME PCC-2
- 4.Materials of Construction (Ferrous and Non - Ferrous)
  - 4.1.Material Selection
  - 4.2.Material Standards and Specification
  - 4.3.Basic Metallurgy and Application
  - 4.4.Material Properties
    - 4.4.1.Stress-Strain Diagram
    - 4.4.2.Fracture Toughness
    - 4.4.3.Impact Properties
- 5.Design of Pressure Vessels (General Theory)
  - 5.1.Properties and Mechanics of Materials
  - 5.2.Failure Theories
  - 5.3.Basis for Design Per ASME Div.1 Code
    - 5.3.1.Weld Joint Efficiency
    - 5.3.2.Internal Pressure Design
      - 5.3.2.1.Shell and Head Design
    - 5.3.3.External Pressure Design
      - 5.3.3.1.Shells and Heads, Stiffening Rings Design
    - 5.3.4.Nozzle Design
    - 5.3.5.Saddle Design
    - 5.3.6.Wind Design for Towers
      - 5.3.6.1.Natural Frequency
    - 5.3.7.Seismic Design
    - 5.3.8.External Loads on Nozzle and Attachments (Lifting Lugs)
      - 5.3.8.1.WRC 107 and WRC 297
  - 5.4.Basis for Design Per ASME Div.2 Code
    - 5.4.1.Introduction to Design by Rule
    - 5.4.2.Introduction to Design by Analysis
- 6.Design of Heat Exchangers
  - 6.1.Brief Introduction to TEMA and ASME UHX
  - 6.2.Design of Flanges per ASME Div. 1 Code
  - 6.3.Design of Tubesheet and End Covers (ASME and TEMA)
- 7.Fabrication and Testing

**Course Content**

- 7.1.Welding
- 7.2.Post Weld Heat Treatment
- 7.3.Impact Testing
- 8.Pressure Vessel Internal Design
  - 8.1.Ring Supports
  - 8.2.Catalyst Bed Support Design/Evaluation
  - 8.3.Outlet Collector
- 9.ASME PCC-2 – Repair of Pressure Equipment and Piping
  - 9.1.Introduction to PCC-2
  - 9.2.Lap Patch Design
  - 9.3.Full Encirclement Sleeve
  - 9.4.Welded Leak Box Repair
- 10.Project Engineering
  - 10.1.NPQC for the Mechanical Engineer
  - 10.2.Reviewing Equipment Drawings and Specifications
  - 10.3.Spot checking and validating vendor calculations
- 11.Rerating of Vessels and Exchangers using Compress

**Instructor:**

Nadarajah ("Ranjan") Chithranjan, Ph.D, PE, career has spanned over 18 years of worldwide involvement in petrochemical industries for ExxonMobil Research and Engineering. Prior to joining Becht Engineering, he worked as a fixed equipment specialist at ExxonMobil Research and Engineering and he has worked in more than a dozen countries worldwide to solve complex mechanical plant problems as well as mechanical support for large scale projects. He has extensive knowledge in pressure vessels, piping, and storage tanks, design and maintenance codes. At ExxonMobil, he was the lead fitness for service specialist and he is very well versed with the fitness for service codes as well as linear and non linear finite element methods to solve complicated plant problems. Ranjan was also the Mechanical Delayed Coker and Storage Tank subject matter expert at ExxonMobil Research and Engineering. He was a former member of API 650 Welded Steel Tank for Oil Storage and presently he is a member of the ASME Working Group on Section VIII, Division II, Design by Analysis and Working Group on Section VIII, Division II, High temperature design. He has more than twenty publications and two patents. Dr. Nadarajah received his PhD and Bachelors in Mechanical Engineering from the University of Strathclyde, Glasgow, United Kingdom.