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Pressure Vessel Design

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Course Syllabus

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PV Design

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Syllabus

- ✓ **Volume-I** Introduction
- ✓ **Volume-II** PV Elite Tools
- ✓ **Volume-III** Equipment Modelling
- ✓ **Volume-IV** Shell & Head Design
- ✓ **Volume-V** Nozzle Design
- ✓ **Volume-VI** Inspection & Testing in Pressure Vessel
- ✓ **Volume-VII** Support Design & Analysing
- ✓ **Volume-VIII** Shell & Tube Heat Exchanger Design
- ✓ **Volume-IX** ASME DIV-2 & EN-13445 Design Rule
- ✓ **Volume-X** Stress Analysing Report

Volume-I — Introduction

1. Introduction
2. PV Elite Overview
3. PV Elite features
4. What Can Be Designed?
    a. Complete Vertical Vessels
    b. Complete Horizontal Vessels
    c. Sphere vessel
    d. Heat exchanger
5. Pressure Vessel Design Standard (ASME, European & British)
6. Pressure Vessel definition
7. Pressure VESSEL Scope
8. Design Codes and their Scope
9. ASME Sec VIII Div.1, Div.2, and Div.3, PD-5500, GB-150, etc.
10. Scope and Structure of ASME Sec VIII Div.1
11. Other Codes/Standards to be referred and their Scope
    a. ASME B16.5
    b. ASME B16.47
    c. ASME Sec II-A, Sec II-B, and Sec II-D
12. Types of Pressure
13. Stress and Various Stress Theories

Volume-II — PV Elite Tools

14. File tab
    a. Open
    b. Recent
    c. Save & Save-AS
    d. Import/Export
    e. Print-setup
    f. Preview/Print
    g. Help
    h. System folder
    i. Exit
15. Home
    a. New
    b. Open
    c. Save
16. Utility
    a. Insert element
    b. Propagate Element Diameter
    c. Flip Element Orientation
    d. Zoom Mode
    e. Compute Ligament Efficiencies
    f. Delete Element
    g. Share Information
    h. Select Material
    i. View Element

17. Auxiliary
    a. Pipe properties
    b. Write foundation 3D file
    c. Ringing results
    d. Element properties
    e. Create & review units
    f. Switch datum input
    g. List dialog
    h. Export to DXF file
    i. Create data base
    j. Set configuration parameters
    k. Calculator
18. Units Code
    a. Units
19. Design Code
20. 3D Graphics
    a. Front view
    b. Back view
    c. Top view
    d. Bottom view
    e. Left end view
    f. Right end view
    g. South west Isometric view
    h. South east Isometric view
    i. North east Isometric view
    j. North west Isometric view
    k. Zoom to Extents
    l. Zoom to Window
    m. Orbit
    n. Turn table orbit
    o. Pan & Zoom
    p. Select by window
    q. Select by single click
    r. Translate detail
    s. Insert cutting plane
    t. Make transparent
    u. Display nozzle list
    v. Re-draw the model
21. Tools
    a. Set Configuration Parameters
    b. Select Units
    c. Create\ Review Units
    d. Units Conversion
    e. Edit/Add Materials
    f. Renumbers The Nodes
    g. Flip Model Orientation
22. 3D
    a. Visibility
    b. View Types
    c. 3d Options
    d. Show Materials Show Wall Thickness
    e. Show Temperature Show Pressure

Volume-III — Equipment Modelling

23. Pressure Vessels
    a. Cylindrical Vessels
    b. Spheres
24. Pressure Vessels With Sump
25. Distillation Columns
26. Kettle Re-Boiler
27. Ferment
28. Jacketed Vessels
    a. Conventional Jackets
    b. Half-Pipe or Limpet Coils
    c. Dimple Jackets
    d. Plate Coils
29. Heat Exchangers
30. Modelling Platform, Packing, and Trays in PV-Elite
31. Adding Weights and Forces/Moments in PV-Elite
32. Concept of Lining in Pressure Vessels
33. Body Flange
34. Liquid Information
35. Lifting Lug
36. Packing Data
37. Insulation Data
38. Clip
39. Component Analysis

Volume-IV — Shell & Head Design

40. Shell internal pressure Thickness Calculation
41. Spheres internal pressure Thickness Calculation
42. Shell external pressure Thickness Calculation
43. Spheres external pressure Thickness Calculation
44. Maximum Allowable Working Pressure (MAWP)
45. Maximum Allowable Working Pressure New and Cold (MAPNC)
46. Actual stress calculation at given pressure and thickness
47. Types Of Heads
48. Head thickness and pressure calculation
49. Weld joint efficiency
50. Insulation types and thickness calculation
51. hydro pressure

Volume-V — Nozzle Design

52. Types Of Nozzles
53. Nozzles Orientation and Position,
54. Nozzles Input Options
55. Hillside Nozzle
56. Top Head Adding Radial and Hilli Nozzles
57. Nozzle/Reinforcement Design using ASME Section VIII DIV 1
    a. Method per UG-37
    b. Method per Appendix 1-10

58. Large Nozzles in Cylindrical Shells
59. Nozzle Neck Thickness (UG-45)
60. Nozzle Flanges and Types
61. Selection of Nozzle Flange Rating
62. Drain Pipe Nozzle
63. Local Loads on Nozzle/Shell Junction and Local Load Analysis as per WRC load calculation

Volume-VI Inspection & Testing in Pressure Vessel

64. Destructive Testing
65. Impact Testing and ASME Requirements
66. Non-Destructive Testing (MDMT)
67. Hydrostatic Test and ASME Requirements
68. Pneumatic Testing and ASME Requirements
69. Radiography and ASME Requirements including Joint Efficiencies
70. Liquid Penetrant Testing
71. Ultrasonic Testing

Volume-VII Support Design & Analysing

72. Types of support
    a. Skirt
    b. Legs
    c. Lugs
    d. Saddles
73. Skirt Support Base ring types
74. Basic Skirt Thickness calculation
75. Base ring Thickness Calculations
76. A lateral force from wind or earthquake
77. The weight of the vessel.
78. Concrete pressing stress calculation on the base ring.
79. Foundation bolts tensile stress Calculation
80. Wind Diameter Multiplayer
81. Wind Loads Calculation
82. Seismic Loads Calculation
83. Saddle Support Stress Types and Calculation
    a. Longitudinal
        i. Tensile
        ii. compressive
    b. Shear Stress
    c. Circumferential Stress
84. Legs and Lugs support Design

Volume-VIII Shell & Tube Heat Exchanger Design

85. Scope of Tubular Exchanger Manufacturer's Association (TEMA)
86. Various configuration of Shell & Tube Exchangers as per TEMA
87. Various classes in TEMA (R, C &B)
88. Components of Shell & Tube Heat Exchangers and Purposes
    a. Pressure Components
        i. Shell
        ii. Channel Shell/Bonnet
        iii. Tube Sheets
        iv. Girth Flanges
        v. Tubes (Including Finned Tubes)
        vi. Nozzles and Reinforcement
        vii. Nozzle Flanges
    b. Non-Pressure Components
        i. Supports (Leg, Lugs or Bracket, Saddles and Skirt)
        ii. Baffles, Tie Rods and Spacers
        iii. Earthing Lugs
        iv. Name Plate and Brackets
        v. Pipe and Platform Support Clips
        vi. Insulation and Fire Proofing Supports
        vii. Lifting Lugs, Lifting Trunnions and Tailing Lugs
        viii. Anchor/Mounting Bolts
        ix. Baffles, Tie Rods and Spacers
89. Introduction to Section UHX in ASME Sec VIII Div.1 and various configurations as per ASME
90. Design of Tube Sheet using PV-Elite
91. Practice Exercises in PV-Elite for common configuration of Shell & Tube Heat Exchangers
92. Calculate The Minimum Required Wall Thickness For Tubing
93. U-BEND REQUIREMENTS
94. BAFFLES Plate Thickness Calculation
95. Heat transfer area
96. Heat Exchanger Load case

Volume-IX ASME DIV-2 & EN-13445 Design Rule

97. Difference between ASME Div-1 & ASME DIV-2
98. ASME DIV-2 design Rules and Calculation
99. EN-13445 design Rules and Calculation

Volume-X Stress Analysing Report

100. Customize report header
101. Customize company name
102. Customize the title page
103. Setting default fonts
104. Save reports to Microsoft Word
105. Error Checking
106. Input Echo

107. XY Coordinate Calculations
108. Internal Pressure Calculations
109. Cone Evaluation
110. Support Calculation
111. Tube Sheet Analysis
112. Hydro Test Calculations
113. External Pressure Calculations
114. Weight of Elements
115. Weight of Details
116. ANSI Flange MAWP
117. Total Weight and Detail Moment
118. Wind Load Calculation
119. Earthquake Load Calculation
120. Longitudinal Stress Constants
121. Longitudinal Allowable Stresses
122. Nozzle Analysis
123. Export to DXF File

End
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