

MECHANICAL ENGINEERING

(Diploma / Post Graduate Diploma Professional Course)

IPEBS

ISO 9001-2008 Certified

Process Piping Design & Engineering per ASME B 31.3
(Design, Drafting, Construction & Stress Analysis)



Course Dates: Starts Every 45 Days
(02nd Jan, 15th Feb, 02nd Apr, 15th May, 02nd July, 16th Aug, 03rd Oct & 15th Nov – 2018)

Course Venue: IPEBS, Hyderabad, INDIA.

Note: Download IPEBS Training Calendar for exact course start dates for the year 2018 from www.ipebs.in



PROGRAM OVERVIEW

Process Piping Design & Engineering per ASME B 31.3

This is a comprehensive program designed to present all major topics relative to the Process Piping Drafting, Detailed Engineering / Layout Engineering of Piping Systems, Mechanical design, Hydraulic design, Construction of Piping Systems and Stress Analysis of Process Piping Systems.

The program also covers Process Equipments, Plant Layout, and Mechanical & Hydraulic Design of Pipelines. It is one of the Unique Training Program which covers comprehensive Static Stress Analysis of Piping Systems along with CAESAR – II software.

The program duration is 45 days Full time Instruction including concept theory, design calculations, piping drawings, system design, drafting and exposure to Industry Leading Pipe Stress Analysis Software (CAESAR – II).

WHO SHOULD ATTEND

Fresh Mechanical / Chemical Engineering Graduates, Diploma & ITI.

Practicing Piping Design/Layout Engineers, Piping 3d Cad Engineers, Piping Draftsmen, Piping Construction Engineers, Piping Fabrication Engineers, Piping Supervisors, Piping Stress Engineers, Piping QA/QC engineers.

WHAT YOU WILL LEARN

Upon completion of this course the participant will be able to

- Perform various tasks in piping works, which can be related to Layout & Design, Drafting, Stress analysis & Construction, in Design Office, EPC Companies, & Plant Owner Companies.
- Create & Understand Piping Layouts and Isometrics.
- Create MTO (Material Take off).
- Establish Pressure Ratings for Piping Components, Valves / Flanges.
- Select Flange, Gaskets, Valves etc.
- Understand & Use ASME Code & Standards.
- Understand Equipment Vendor Drawings.
- Create Plant equipment & piping layouts.
- Understand Flow Diagrams (BFD/PFD's & P& ID's).
- Interpret Pipe Properties.
- Create Piping Material Specifications.
- Perform Pressure Design/Hydraulic Design Calculations.
- Piping Stress Requirements.
- Perform Manual Pipe Stress Calculations using formulae, graphs, charts, nomographs.
- Use CAESAR II Software to create 3d models of Piping Systems & Perform Static Stress Analysis.
- Understand Piping Construction Requirements including Non Destructive Examination (NDE), Testing of Piping Systems, Fabrication Requirements, Assembly & Erection Practices.

“Gain complete understanding of Piping Systems, related Standards, Piping Drawings, Design Calculations, stress requirements.”

“Attend this knowledge – packed professional training diploma course & become a Piping Specialist”

Trainer Synopsis

- Faculty with 15 years of practical consulting & construction experience.
- Gulf Experienced.
- International Corporate Speaker & Trainer.
- Practicising Piping Engineering Consultant for India / International Projects.

Walk – in for a Training Demo – Orientation / Course Overview by Course Upcoming Start Date.

Training Features:

- Individual Attention & Placement Guidance.
- Thousands of Trained Engineers working in India & Middle East, Far east & Europe, .
- Excellent Training Material provided including (Piping Manual, Piping Data Book, Demo Software's, Drawings & Project Work)

COURSE MAJOR MODULES

I) Piping Systems Detailed Engineering /Plant & Piping Layout Engineering / Piping Drafting.

- Piping Fundamentals
- ASME Codes & Standards
- Pipe Fittings
- Flanges
- Valves
- Special Elements
- Mechanical/Process Equipments
- Flow Diagrams
- Piping Specifications
- Piping & Equipment Layout
- Piping Isometrics
- Piping Spools
- Pipe Supports

II) Piping & Pipeline Systems Design.

- Pressure Design of Process Piping Systems/ Pipelines/ Building Services Piping.
- Hydraulic Design of Liquid Piping Systems & Pipelines.

III) Pipe Stress Analysis.

- Introduction
- Pipe Span Calculations
- Expansion Loops & Expansion Joints
- Layout Solutions for Weight, Thermal, & Wind Loads.
- Sustained Loads
- Flexibility Analysis using Code Equations
- Occasional Loads

IV) CAESAR II – Software Static Analysis.

DETAILED PROGRAM DESCRIPTION

I) Piping Systems Detailed Engineering /Plant & Piping Layout Engineering / Piping Drafting.

Module – 1) Piping Fundamentals

- Introduction to Process Plants
- Difference between Code and Standards
- Scope of Piping in Projects.
- Plant Piping Systems and Transportation Pipelines.
- Definition & Application of Pipe
- Difference between pipes and tubes,
- Pipe Designators – NPS , IPS , NB, Pipe Wall Thickness & Schedule, Pipe Weights, Lengths, Grades, Ends, Joining Methods, Methods of Manufacture, Pipe Ratings, Pipe Symbols.
- ASTM Specifications of pipes.

Module - 2) Pipe Fittings – ASME Standards, Selection, Application, Drawing Symbols & Dimensioning.

- Types of Fittings – Butt Weld, Screwed & Socket Weld.
- Elbow – 90 degree (LR & SR), 45 degree, Reducing Ell, Elbow Representations on drawings, different views, drawing call outs .
- Pipe Bends – Miter Bends, Miter types, Miter angle determination, Miter stress requirements, 180 degree Return, Representations on drawings.
- Branch Connections – Weld Straight & Reducing Tee, Cross & Lateral. Representations on drawings, drawing call outs.
- Reducers – Concentric & Eccentric, Reducer Offsets Representations on drawings, Drawing call outs.
- Eccentric reducer applications, offset calculation.
- Stub Ends, Stub end types: Long, Short, Class A, Class B Representations on drawings, Application of Stub Ends.
- Fabricated Branch Connections – Stub In & Stub On, Representations on drawings, Welding Minimums for Stub In.
- Branch Reinforcements – Reinforcing Pad, Welding Saddle, Representations on drawings, Drawing call outs.
- O let Fittings – Weldolets, Sockolets, Thredolets, Latrolets, Elbolets & Sweeplets, Nipolet, Flangolet Representations on drawings.
- Types of Couplings: Full coupling, Reducing coupling, Half coupling, Representations on drawings, Drawing call outs.
- Weld Cap, Plug, Representations on drawings, Drawing call outs.
- Fitting Makeup – Dimensioning, Placement of Dimensions.
- Minimum Pipe length requirements.
- Screwed & Socket Weld Fittings – Union, Plug, Coupling, Types of couplings, coupling applications. Types of Swages, Swage end configurations. Swage applications.
- Classes of Screwed & Socket Weld Fittings
- Dimensioning Exercises

Module - 3) Pipe Flanges – ASME Standards, Symbols, Selection & Application.

- Definition of Flange.
- Types of Flanges and Application, P-T. Ratings. – Forged Steel and Cast Iron Flanges.
- Flange Facings – Flat Face, Raised Face, RTJ, & Male - Female, Tongue & Groove. Flange Face Finish types, application.
- Weld Neck, Slip On, Threaded, Socket Weld, Lap-Joint, Reducing, Blind & Orifice Flanges.
- Flange considerations by a Piping Engineer and by Code. Bolt hole requirements. Bolts & Nuts types.
- Gaskets – Types, Thickness, selection requirements
- Flange selection exercise.
- Dimensioning Exercises.

Module - 4) Valves – ASME/API Standards, Symbols, Selection & Application.

- Definition.
- Valve Functions, P-T Ratings, Difference in Valve and flange Ratings, Valve Tag numbers, Locations & End Connections.
- Valve Types – Gate, Globe, Ball, Check, Butterfly, Angle, PRV/PSV, Plug, Control Valve, Diaphragm, Needle, Piston, Flush bottom, 3-Way, 4-Way, etc.
- Control Valve Manifold: Types, Function, Layout types, Representation & Requirements on flow Diagrams and Layouts.
- Valve Operators.
- Valve Data Sheet preparation and understanding.
- Valve Trim.

DETAILED PROGRAM DESCRIPTION (contd)

- Valve Selection.
- Valve Layout Considerations.
- Dimensioning Exercises.

Module - 5) ASME Codes & Standards

- Introduction to ASME Pressure Piping Design Codes.
- ASME Standards for Common Piping Elements.
- API Codes.
- Other Codes & Standards.

Module - 6) Piping Special Elements.

- Strainers
- Bellows/Expansion Joints.
- Rupture Disc.
- Spectacle Blind.
- Blanks.
- Spacers.
- Steam Traps.
- Flame Arrestor.
- Vortex Breaker.

Module - 7) Process Mechanical Equipments – API Standards, Symbols, & Application.

- Static – Horizontal Vessels, Distillation columns, Storage Tanks, Heat Exchanger & Re boiler, Fired Heaters, Reactors, Cooling Towers.
- Rotary – Pumps, Compressor, Fans.
- Vessel trim.

Module - 8) Flow Diagrams.

- Block flow Diagrams-BFD,
- Process Flow Diagram – PFD.
- Utility Flow Diagram- UFD,
- Piping & Instrumentation Diagram – P & ID.
- Line Numbering,
- Line Number requirements,
- Piping Tracing(Jacket Piping ,Steam/Electric tracing).
- P& ID Requirements,
- Line Designation table/ Line list creation from P & ID.
- Print Reading Exercise,
- Flow Diagram Exercises,
- Symbols & Abbreviations.
- Equipment vendor data/PDS,
- Instrument Types & Symbols – Flow, Temp, Pressure & Level.
- Instrument Hook-up Drawing

Module - 9) Piping Material Specification (PMS)/ Piping class

- PMS and its requirements,
- Piping Specifications / Material Selection / P-T ratings / Valve Data / Branch table / Abbreviation details.
- PMS Application/Use by various departments.

DETAILED PROGRAM DESCRIPTION (contd)

Module - 10) Plot Plan, Equipment Layout, & Piping GA Drawings.

- Plot Plan Development & Requirements.
- Layout Terminology & call outs,
- Control Point & Plant north, Battery Limits.
- Equipment Layout: Types, Guidelines for preparation based on type,
- Guidelines for Building layout types.
- Piping GA Drawing Requirements and Layout Procedure.
- Pipe routing requirements
- Pump GA Drawing and Layout Consideration.
- Tank & Vessel Layout Consideration.
- GA - Print Reading Exercise.
- Inputs(Drawings/Documents) for piping G A drawings.

Module - 11) Piping Isometrics

- Isometric requirements
- Drawing Piping Isometrics
- Isometric Dimensions, Notes & Callouts.
- Isometric Offsets.
- Print Reading Exercises.
- Exercises on Creation of Isometrics form Piping Plans and Sections.
- Inputs (Drawings/Documents) for piping Isometric drawings.

Module - 12) Piping Spools

- Definition
- Types of Spool Drawings.
- Guidelines to Prepare Spool Drawings.
- Print Reading Exercises.
- Exercises on Creation of Piping Spool from Piping Isometrics.
- MTO (Material Take Off): Types, and applications.

Module - 13) Pipe Supports

- Classification of Supports.
- Primary supports
- Secondary supports
- Rest supports
- Anchor supports
- Standard supports
- Standard support details required
- Non Standard supports/Special pipe supports(SPS)
- SPS requirements.
- Anchors.
- Pipe Guides.
- Limit Stops.
- Pipe Shoe.
- Shoe Guides / Hold down guides,
- Dummy Leg / Trunion.
- Field Support / Base Support.
- Rigid Hangers – Rod & Clevis, Trapeze.
- Pick up supports,
- Flexible/Spring supports – Variable & Constant.
- Control valve manifold supports.
- Piping support Engineer work procedure.
- Pipe Rack Design – Types, Height & Width Calculations, Pipe Arrangements.
- Control Station & Utility Station on Pipe Racks.

DETAILED PROGRAM DESCRIPTION (contd)

II) Piping Systems Design

Module - 1) Pressure Design of Process Piping Systems – ASME B 31.3.

- o Scope of ASME B 31.3, B31.4 & B 31.8
- o ASME B 31.3 Fluid Service Categories.
- o Design Pressure & Design Temperature for Piping Systems.
- o P-T Rating Determination of Flanges, Threaded & Socket Weld Fittings.
- o Pressure Design of Straight Pipe under Internal Pressure. – Wall thickness Calculations.
- o MDP – Maximum Design Pressure for Piping Systems
- o Branch Reinforcements – Reinforcement Pad Calculations.
- o Pressure Design of Miter Bends – Single & Multiple Miters.
- o Pressure Design of Blanks.
- o Pipeline Wall thickness Calculations – B 31.4 / B 31.8.
- o MAOP – Maximum Allowable Operating Pressure for Pipelines.
- o Piping Material Selection per ASME Code.

Module - 2) Hydraulic Design of Liquid Piping Systems & Pipelines.

A. Pressure Drop Due to Friction

- o Velocity Variation in Pipes
- o Typical Velocities for Water Piping & Other Liquids
- o Pipe Sizing
- o Hazen Williams Equation
- o Darcy Weisbach Equation
- o Friction Factor
- o Reynolds Number
- o Colebrook White Equation
- o Moody Diagram
- o Minor Losses in Pipe Fittings – Equivalent Length Method & K-Factor method.

B. Pressure & Horse Power Required

- o Total Pressure Required to Transport – Friction Head, Elevation Head, And Minimum Delivery Pressure.
- o Elements of Total Dynamic Head – Static Head, Pressure Head, Velocity Head, Friction Head.
- o Pump Horse Power Required.
- o Cavitation in Pumps.
- o NPSH Required & NPSH Available for Pumps.

III) Pipe Stress Analysis

Module - 1) Introduction

- o Objectives & Definition of Stress Analysis
- o Piping Loads – Primary, Secondary, Sustained Loads, Occasional Loads, Static & Dynamic Loads.
- o Piping Stresses- Primary, Secondary.
- o Stresses acting in Pipe due to internal Pressure.
- o Stresses acting in Pipe due to pipe weight.
- o Critical Line List & its criteria.
- o Information Required for Stress Analysis.
- o Occasional Loads
- o Wind Load.
- o Seismic Load.
- o Water Hammer Load.
- o Theories of Failure.
- o Requirements of ASME B 31.3 Code – Sustained Loads, Thermal Expansion & Occasional Loads.

DETAILED PROGRAM DESCRIPTION (contd)

Module - 2) Pipe **Span Calculations**

- Span limitations based on Stress, Deflection & Natural Frequency.
- Allowable Pipe Span Calculations.
- Suggested Pipe Support Spacing.
- Pipe Span Reduction Factor for Elbows, Concentrated Loads etc.

Module - 3) Flexibility Analysis – Expansion Loops & Expansion Joints.

- Concept of Thermal Expansion.
- Providing Flexibility in Piping.
- Minimum Leg Required to Absorb Thermal Expansion.
- Stress Nomographs for Pump and Vessel Piping.
- Types of Expansion Loops.
- Expansion Loop Sizing for Hot Piping.
- Expansion Loops requirements on pipe racks.
- Nozzle Thermal Growth Calculations – pumps, vessels, heat exchangers.
- Expansion Joints – Types, Application & Selection.
- Bellow Materials, Hydrostatic Test Pressure for Bellows.
- Guide Spacing for Expansion Joints.
- Severe Cyclic Conditions.

Module - 4) Layout Solutions for Weight, Thermal, Vibration & Wind Loads.

- Causes of Pipe Stress.
- Solving Concentrated Loads and Reducing Loads on Equipment Nozzles.
- Checking Piping Layout in Pipe Racks.
- Checking Piping Layout for Reciprocating Equipment.
- Checking Piping Layout for Wind Load.
- Solutions for piping loads.
- Selection of Supports, Location of Supports and Restraints on a Pump Piping Layout.

Module – 5) Flexibility Analysis using ASME B 31.3 Code Equations.

- Thermal Expansion Stress – S_e , Code Allowable Thermal Displacement Stress Range S_a .
- Stress Range Reduction Factors – f .
- Bending & Torsion Stress.
- Formal Analysis Requirements.
- Inplane & Outplane Bending Moments
- Stress Intensification Factors – SIF.
- Calculation of Thermal Expansion Stress
- Cold Spring.

IV) CAESAR – II – Pipe Stress Analysis Software

- Introduction.
- Piping Input Spreadsheet.
- Modelling of Piping Isometrics – Bends, Returns, Reducers, Valves, Loops etc.
- Performing Static Analysis.
- Load case explanations
- Modifying Load Cases.
- Hanger Selection.
- Set up of SUS, OPE, EXP, HYD, HGR Load cases.
- Set up of Wind Load cases.
- Set up of Uniform Load cases.
- Load Case Editor.
- Evaluating API 610 Pump Nozzle Loads.

DETAILED PROGRAM DESCRIPTION (contd)

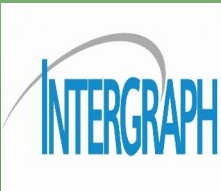
- WRC Nozzle load calculations.
- Viewing Reports.
- Word/Excel file conversion of reports.
- Making/Reviewing unit files.
- Importing Lines for stress analysis.
- 10 Practical Examples – Input, Analysis & Redesign.

***Numerous Examples are covered to illustrate application of Piping Systems Detailed Engineering / Layout Engineering & Pipe Drafting. Application of ASME B31.3 Code for Piping Design, Construction & Integrity.**

***100 Practical Examples shall be covered during the course for Detailed Engineering, Design & Stress Analysis.**

***Oil Refinery Project on Detailed Engineering of Piping Systems.**

SELECTED CLIENTS



GENERAL INFORMATION:

- Participants are expected to be present each day and during all training periods. Participants who do not fulfill the attendance requirement will not be certified. Please remember this when making your travel arrangements.
- Course fee includes Printed Training Materials (Manual, Hand outs etc.), & Participants will be awarded with Diploma / Post Graduate Diploma Certificate (*QMS Accredited to *AIAO – BAR).
- Venue for the Diploma Courses will be IPEBS facility, Hyderabad.
- The course is restricted to registered participants only. Visitors are not permitted.
- Use of mobile phones, Personal Data Assistants (PDA, Blackberry) and pagers is not permitted during training periods. Same applies for use of laptop, tablet, and computer for any purpose (E-mail, games etc.) other than course training.
- Participants are expected to maintain a professional standard of appearance and behavior. Any participant wearing inappropriate attire or behaving in an unprofessional manner will be given a verbal warning. Further incidents may result in the participant being asked to leave the class without refunding their fee.
- Failure to meet or comply with these requirements will result in non-certification.
- Accommodation can be arranged on request for the participants near to the training facility. (Accommodation is not included in the course fee).
- **International participants** registering for the diploma courses, please contact IPEBS by email to info@ipebs.in for further course details & visa assistance.

NOTE: 1) QMS – Quality Management System (ISO 9001 -2008).

2) AIAO – BAR – American International Accreditation Organization, California, USA.

WHY TRAIN WITH IPEBS

IPEBS team develops the training programs based on the practical consulting and site construction expertise that has been built up over the years in various specialist areas.

We set out to teach top-quality engineering skills training courses and we have achieved this-we constantly strive to make them as good as it's possible to – but over the years we have also refined our methods, adding several enhancements to the construction stages of course description, design of the courses and assessment.

We believe that these are important to our training participants; it's easy to see what the courses consist of, what value they will gain from attending them and how they can apply their new knowledge and skills in their workplace in a structured, evidence-rich way.

INSTRUCTOR PROFILE

- ❖ Mechanical Engineering Graduate from JNTU, Hyderabad
- ❖ Over 16 years of experience in Plant Engineering (Operations & Maintenance), Process Plant piping & pipeline layout, design, Stress Analysis & Construction.
- ❖ Worked in Gulf Countries & India as Mechanical Maintenance Engineers & Senior Piping Engineer for Consulting & Construction Companies.
- ❖ Major work areas included Plant Piping 3d Modeling, CAESAR II flexibility analysis, piping & equipment layouts, pipe support design, ASME Code calculations – Piping Material Specifications, Piping Maintenance - Corrosion Control, Repair, Re-rating, Non Destructive Examination , Testing of Piping Systems, Piping Construction including Fabrication , Assembly & Erection, QA / QC for various oil & gas projects.
- ❖ Expertise in Various Codes & Standards including ASME, API, DIN, IS & BS.
- ❖ Successfully trained more than One Thousand Piping Engineers.
- ❖ International Course Speaker.
- ❖ Over 6 years of Quality Training Experience in Piping & Pipeline Engineering Courses.
- ❖ Practicing Piping Engineering Consultant for local & International Projects.

DIPLOMA COURSE	DURATION	TIMING
Process Piping Design & Engineering per ASME B 31.3 (Design, Drafting, Construction & Stress) *For course fee details please contact , E-mail: info@ipebs.in Phone: +91-40-30623249, Mobile: +91-9885946711	45 Days (Inclusive of Public Holidays)	10:00am to 03:00pm
Can't take 4-6 Weeks for training? Attend the Accelerated Training Workshop - A 5-Day Version of our Highly Acclaimed Diploma Courses. For Further details about Workshops, please visit our website www.ipebs.in		
Interested In Onsite training , For further Information on Onsite Trainings please contact , E-mail: corptrain@ipebs.in Phone: +91-40-30623249, Mobile: +91-9885946711		

Terms & conditions:

CANCELLATIONS: IPEBS does not provide refunds for Cancellations done after registration & fee payment. However, credit maybe granted to a later program. This credit will be available for up to one year from the date of issuance.

COURSE MATERIAL AGREEMENT: It is the intention of IPEBS that the course text and materials supplied to participants at IPEBS courses are prepared and issued for the participants' sole use. Codes and standards constantly change and interpretations are issued by the publishing societies. Information contained in IPEBS course materials is based on the best available data obtained by IPEBS at the time of publication. IPEBS is in no way responsible for subsequent use regardless of intention.

PROGRAM CHANGE POLICY: Please note that instructors and topics were confirmed at the time of publishing this document; however, circumstances beyond the control of the training organizers may necessitate substitutions, alterations or cancellations of the instructors and/or topics. As such, IPEBS reserves the right to alter or modify the instructors and/or topics if necessary. Any substitutions or alterations will be updated on our web site.

COURSE CANCELLATION BY IPEBS: IPEBS reserves the right to cancel any course due to circumstances beyond our control. All tuition fees will be refunded in the event of cancellation. IPEBS liability is limited to only those tuition fees paid in advance.

FORCE MAJEURE: Except for the obligations to make money payments as outlined hereunder, neither party shall be responsible to the other for delay or failure to perform any of the terms and conditions, or other activities, of this agreement if such delay or failure is caused by strike, war, act of God, or force majeure.

REGISTRATION FORM

Please visit www.ipebs.in for details on courses we offer and more updated information.

You can register online.

Or

For applications by E-mail, please fill the form below and send to info@ipebs.in

**COURSE TITLE: Process Piping Design & Engineering per ASME B 31.3
(Design, Drafting, Construction & Stress Analysis)**

COURSE DATE: _____ COURSE LOCATION: _____

NAME: _____ NATIONALITY: _____

QUALIFICATION: _____ WORK EXPERIENCE (if any): _____

JOB TITLE: _____ COMPANY: _____

ADDRESS: _____

CITY: _____ STATE: _____ POSTAL CODE: _____ COUNTRY: _____

PHONE: _____ FAX: _____ EMAIL: _____

In case of Emergency, contact

NAME: _____ PHONE: _____

ADDRESS: _____

EMAIL: _____

NOTE: Training Fee can be paid at the time of Joining the Course.

I, acknowledge to the terms & conditions of the organizer.

Date: _____

Signature: _____

IPEBS
204, C-Block, 2nd Floor,
Mayur Kushal Complex,
Beside Chermas Showroom Abids,
Hyderabad-500001, Telangana. (INDIA)
Tel: +91 - 40 -30623249
Mob: +91 - 9885946711

info@ipebs.in | www.ipebs.in