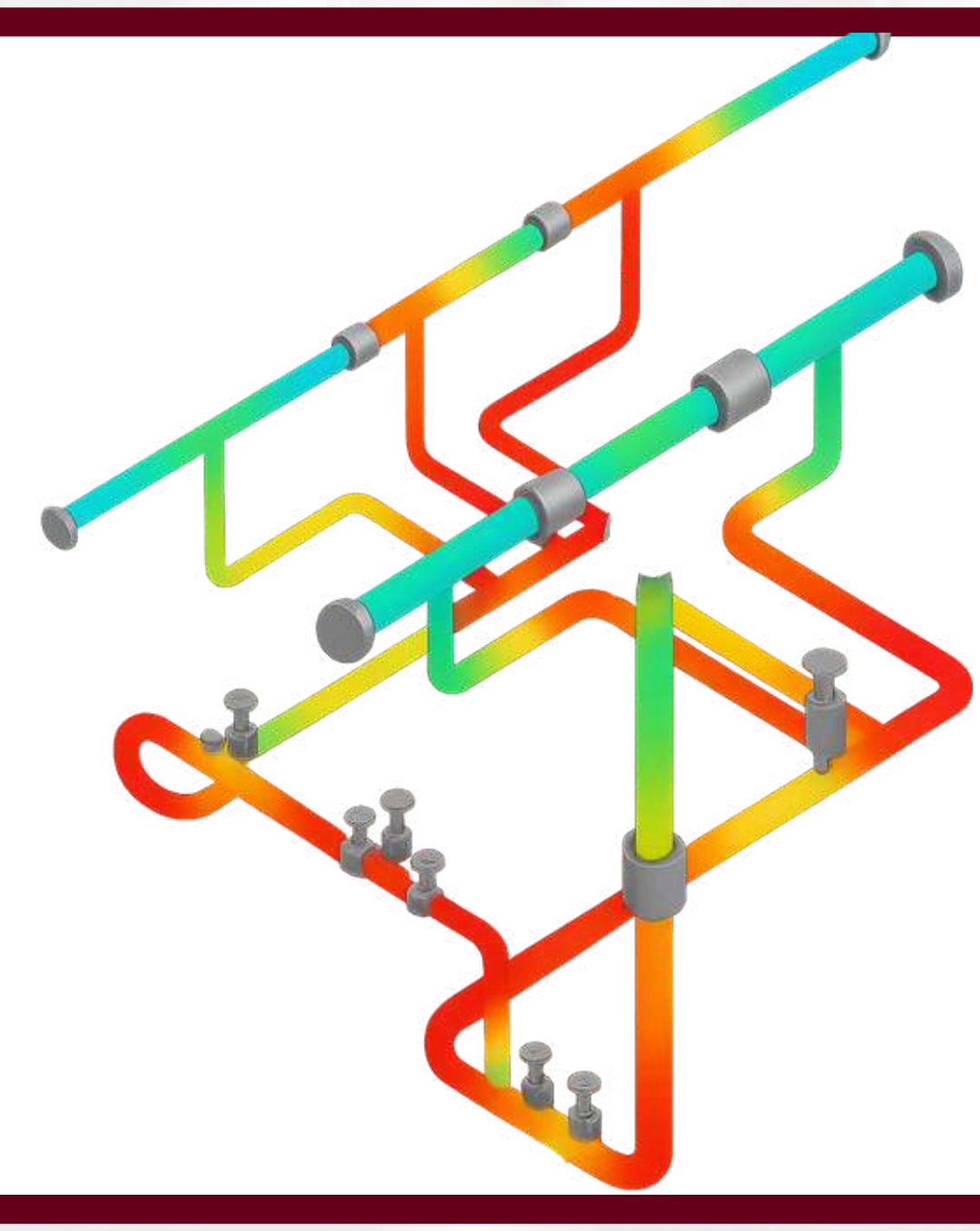
EXPRESS ENGINEERING SOLUTIONS

COMBO

PIPING & PIPELINE STRESS ANALYSIS



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1 Combo Piping-Pipeline Stress Analysis

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1 Combo Piping-Pipeline Stress Analysis

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25	Pipeline Analysis and Results interpretation	1
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28	Seismic Analysis of Buried Pipeline	2
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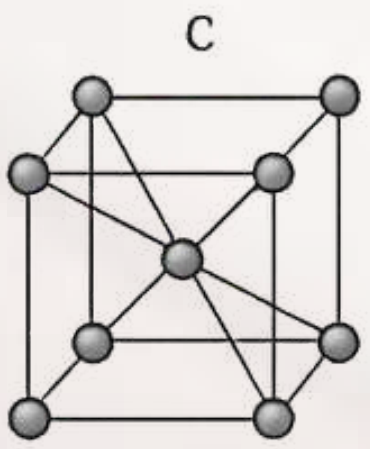
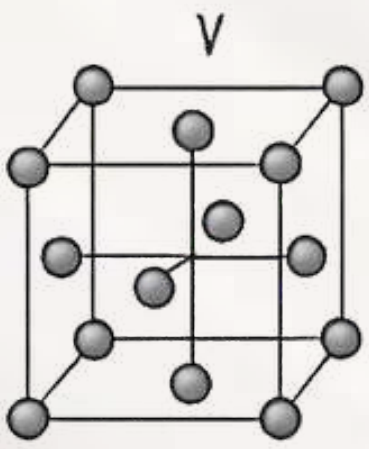
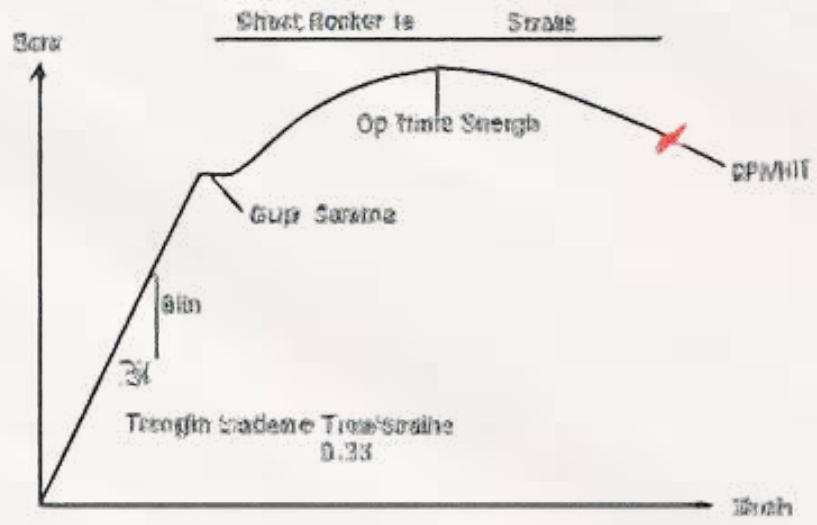
1 Important Concepts Of Stress Analysis Part - 1 (2 hrs)

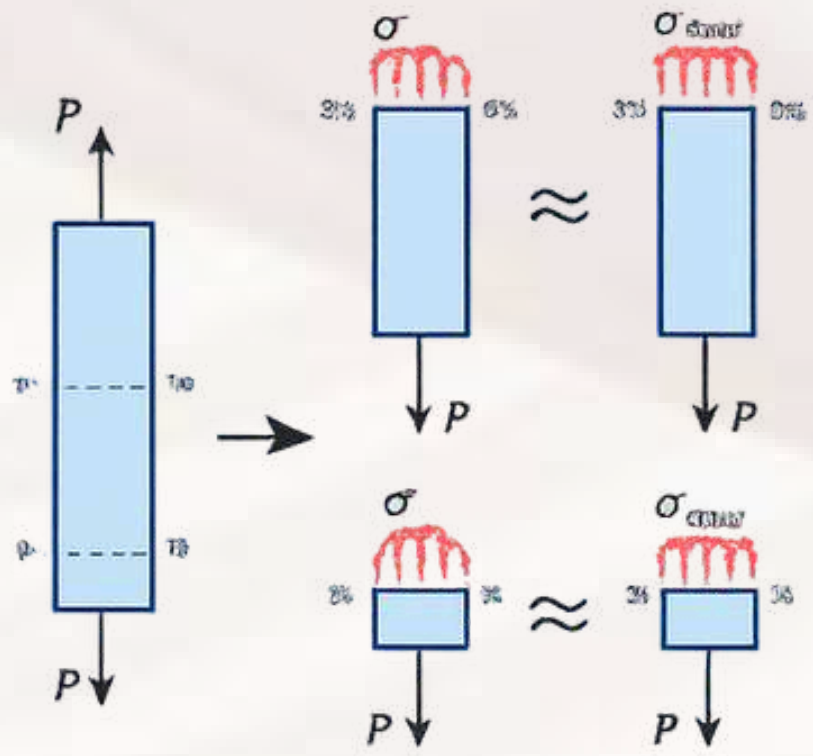
This Course is useful for all engineers who wish to make their basics clear in Pipe stress analysis. If you wish to 'Experience' the 'Stress Concept' and not only wish to understand it mathematically or in bookish language and the most importantly if you possess patience and passion for the subject then this Course is for you. This Course is divided in 3 nos. of videos. In these Courses we will discuss.

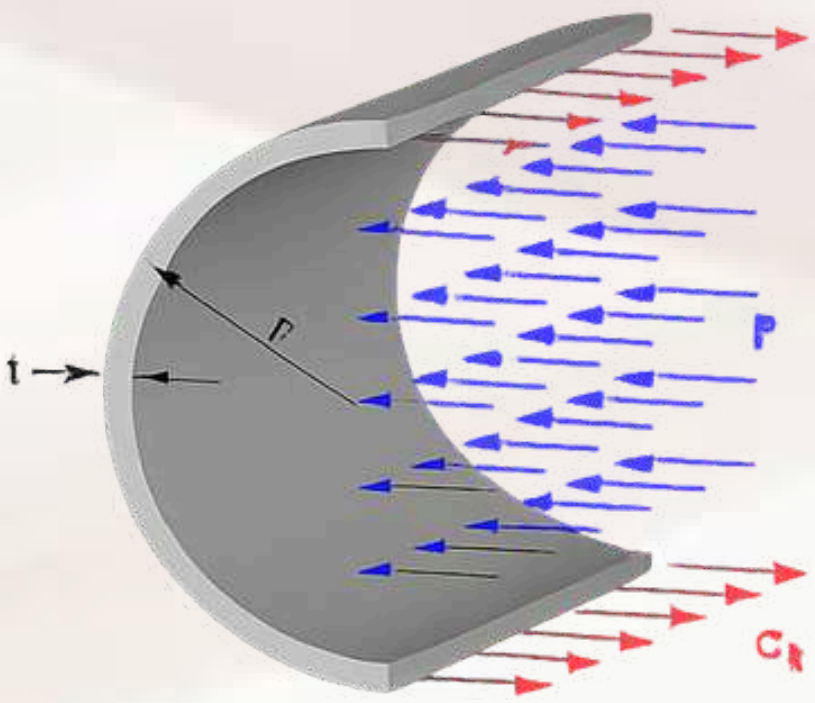
- The concepts of Displacement Filed, Stress & Strain Field.
- Modulus of Elasticity and its significances.
- What is 'Tensor'? stress as a Tensor.
- Longitudinal stress, Radial stress, circumferential (Hoop) stress.
- Moment of Inertia.
- Stress stain curve and practical approach to look towards it.











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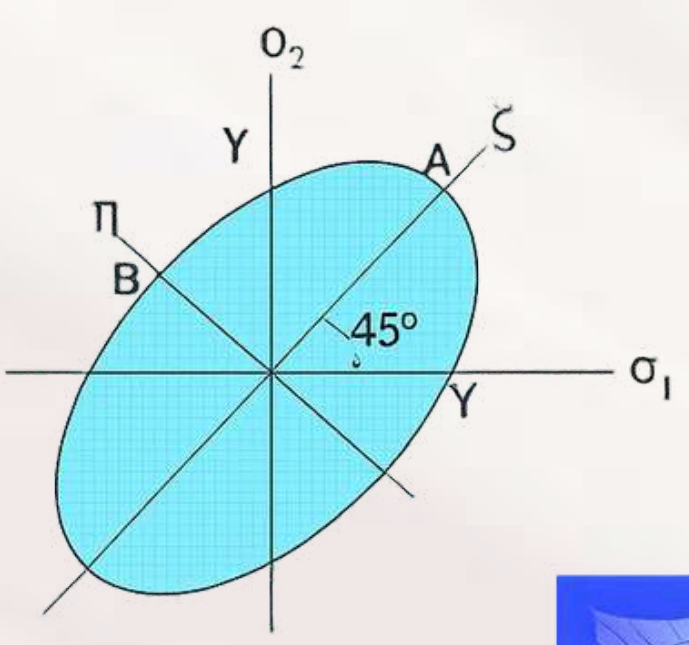
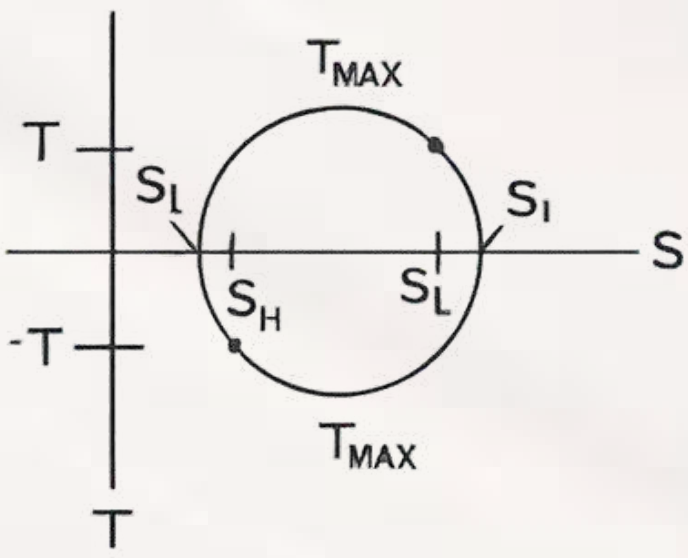
2 Important Concepts Of Stress Analysis Part - 2 (1 hrs)

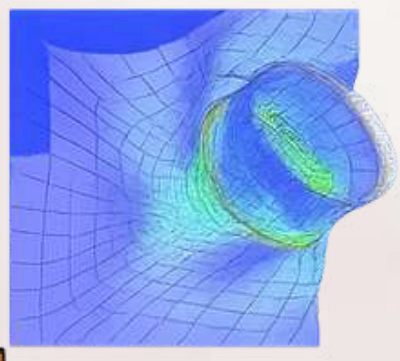
This Course is continuation of Course-1 and hence applicable for all Mechanical, production engineers irrespective of their experience. This Course is extremely recommended for the under graduates, fresh graduates, piping engineers, engineers working 3D state of stress, Mohr's circle, Theories of Failures: at site and stress engineers. We go little deeper into concepts like.

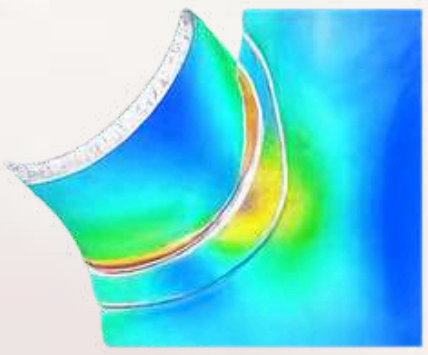
- 3D state of stress.
- Mohr's circle.
- Theories of Failures.
- Maximum Shear Stress Theory.
- Von mises theory.
- Importance of stress analysis.

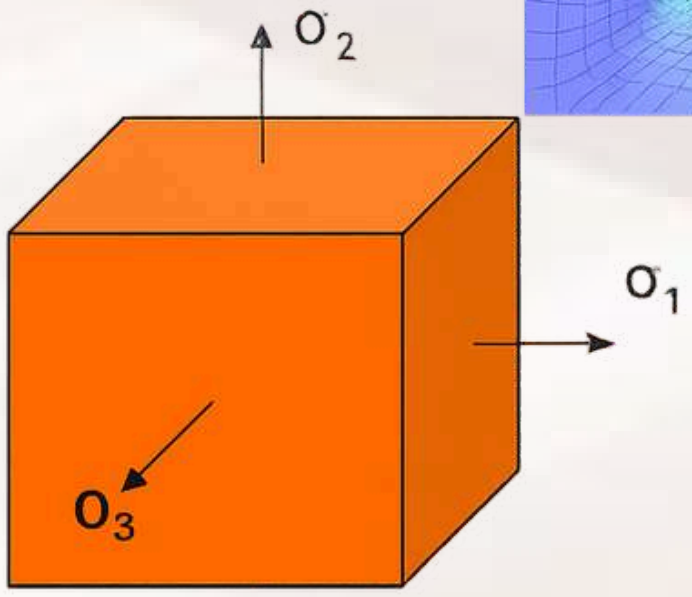
Also, a simple problem is solved by hand calculations to calculate the stresses in the system. The intention of this Course is to make the participant to look at the problem without taking help of software.











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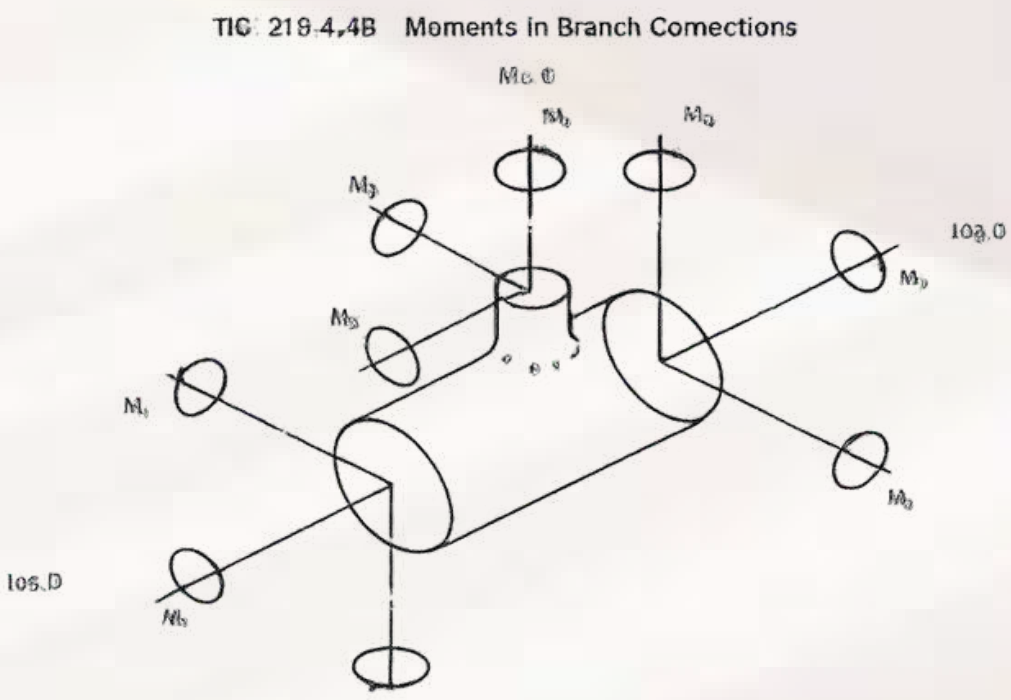
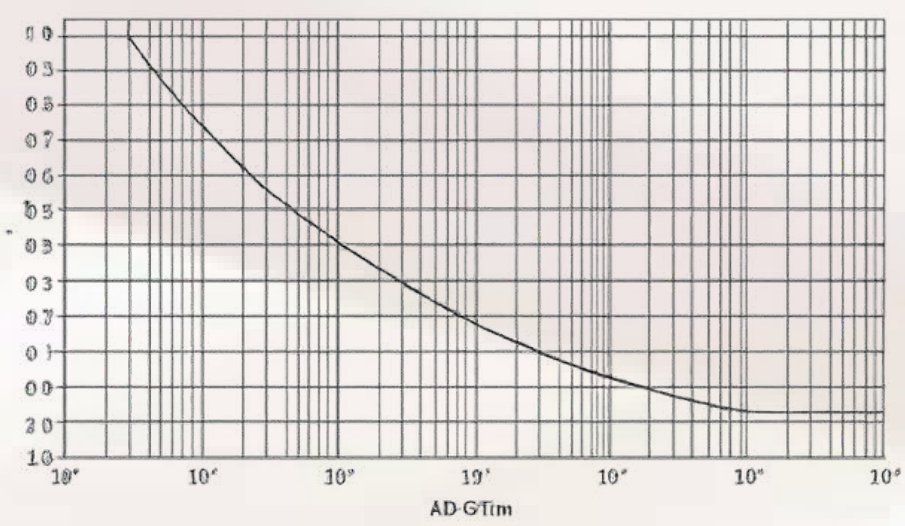
3 ASME B31.3 Code Stress Equations Part - 1 (1 hrs)

A highly recommended Course for all stress and piping engineers. There are various codes based on their applications. For example, ASME B31.1 is for Power piping, B31.3 is for Process Piping, B31.4 is for Liquid Hydrocarbon transportation etc. It is like ‘learning languages very close to each other’. If you know one language and its grammar well then it is simple to grasp other languages. Unfortunately, most of the Piping engineers do not read the code carefully, some of them ‘Read' the code but cannot 'interpret' it. The equations provided in the codes are followed as it is. However, all these equations are closely related to basic stress concepts and engineering theories which we learn in schools, concepts and engineering theories which we learn in schools, universities and if an engineer understands 'Why' behind the code equations, are written in a particular way then he/she gets an ability to relate them with new challenging problems. Also, it makes the understanding of code clear.

This Course talks about-

- Primary stresses and their characteristics.
- Secondary stresses & their characteristics Occasional stresses and their characteristics.
- Which type of stress is more critical.
- Mode of failure of each type.





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4 ASME B31.3 Code Stress Equations: Part 2 (2 hrs)

This Course is continuation of previous Course and hence must be heard after completing Course 3. This talks about the code equations in detail.

- Why equations are written in a particular way.
- What is the significance of + and - sign?
- What is ‘stress range’?
- Stress relaxation.
- Self-springing of material.
- What are liberal stresses?
- Scope and Exclusions of ASME B31.3.
- Primary stresses equation and its allowable.
- Secondary stresses equation and its allowable.
- Occasional stress equation and its allowable.

Process Piping

ASME Code for Pressure Piping, B31

$$S_L = \sqrt{(|S_h| + S_h)^2 + (2S_t)^2}$$

$$S_b = \frac{\sqrt{(I_i M_d)^2 + (I_o M_b)^2}}{Z}$$

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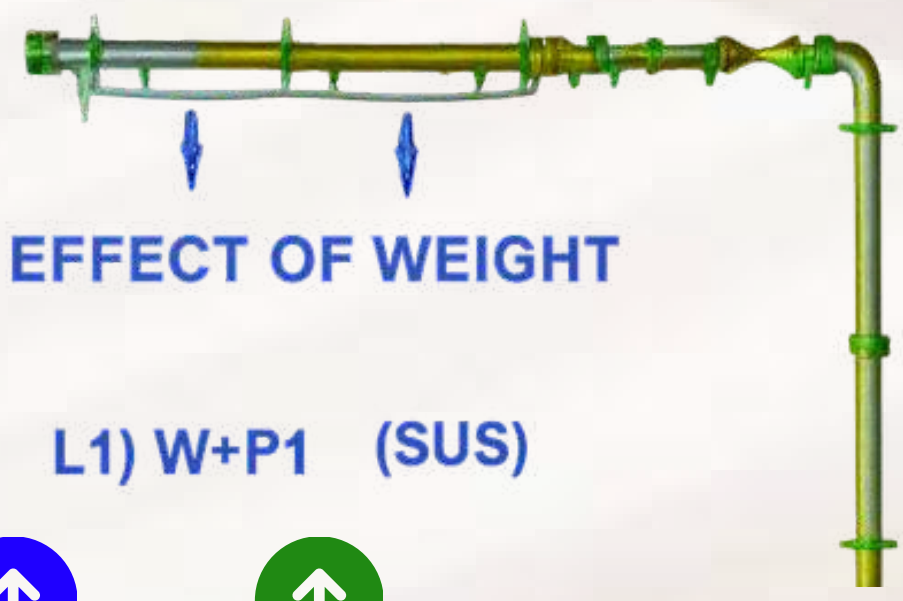
5 BASIC LOAD CASES (2 hrs)

Defining the load cases is very important in pipe stress analysis as it is a relation between the software and the code requirements. Defining right load cases and understanding the mathematics behind the load cases is very essential. Most of the time it has been observed that engineers do copy the load cases or try to learn them by heart.

This Course talks about-

- How to write load cases their nomenclature.
- There are various methods of combination such as scalar algebraic.
- Also, it tells about the answers of many critical questions like ‘why a particular load case is written in a particular way’.
- How to write the load cases using Caesar II software.
- What are the different types of load cases?
- How the allowable stresses are understood by the software when you call a particular load case by a particular name.
- How to write the load cases when a spring is introduced in the system.
- How to write load cases when force present in the system.

This model also relates the load cases with the code equations. This Course is extremely useful to the engineers with experience less than 5 years for those who wish to understand the mathematics and ‘Why’ behind the load cases.



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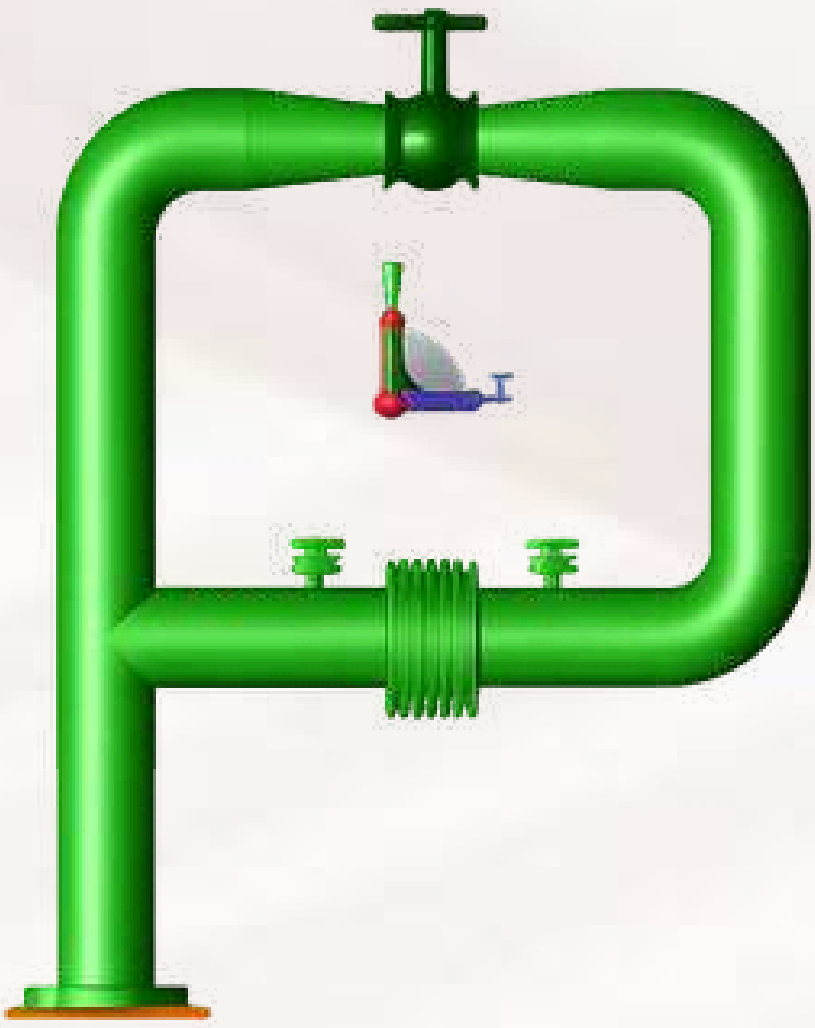
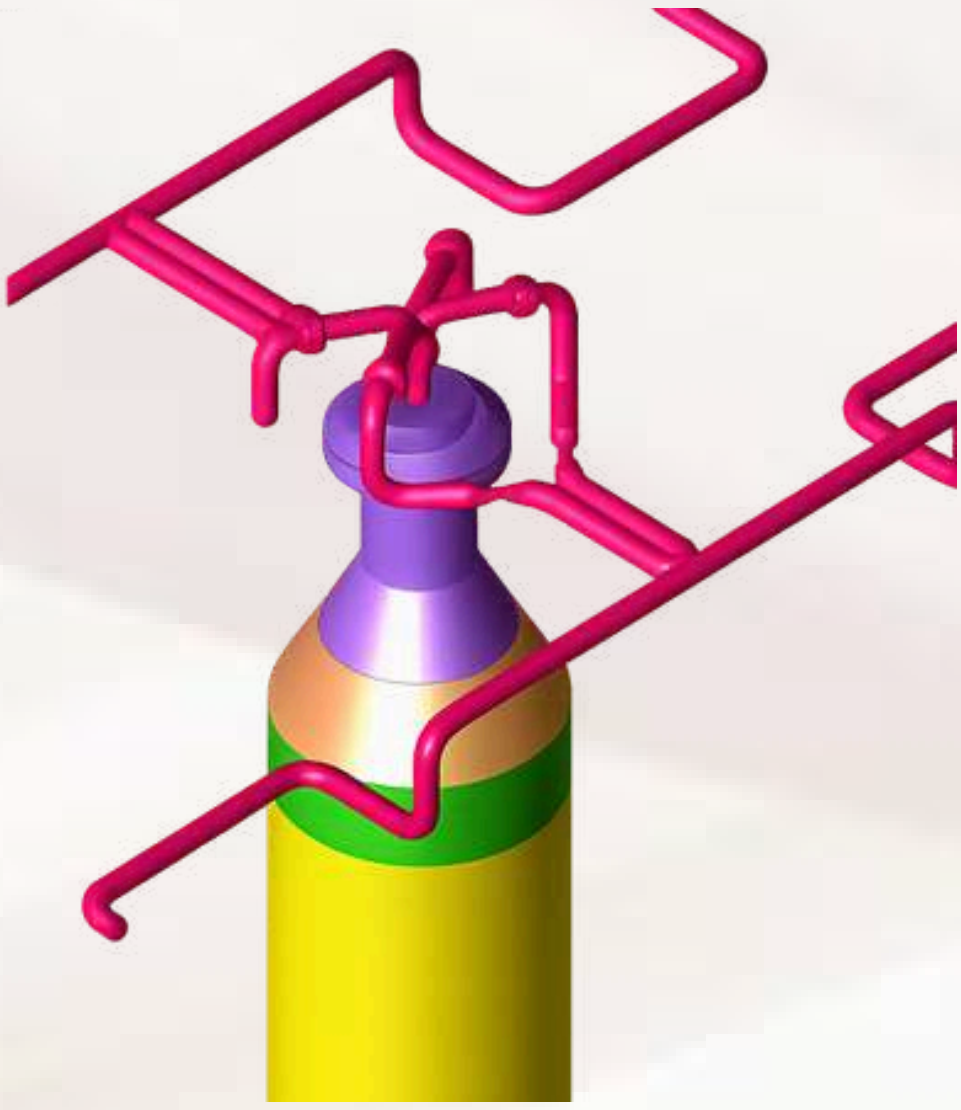
6 Introduction to CAESAR II & Basic Modelling Techniques (3 hrs)

Today's world is software driven. Engineers are no exception to it. It has been observed that engineers cannot give the solution without having software with them. Then it becomes essential to know the advantages and the limitations of the tool we are using. Hence knowing the stress analysis software and its advantages / limitations, the way it has been programmed etc. is very important. CAESAR II is one of the finest stress analysis software using beam element.

In this Course we will learn-

- Basic elements true In this Course we will learn.
- Hand calculation of thermal force and stresses Evaluating them with scissor to answer.
- How software works.
- Important features of configuration setup.
- What is ‘degree of freedom?
- Introduction to modelling commands.
- Node and connecting Node, its application.
- How to apply wind and earthquake loads.
- Advantages and limitations of the software.
- Difference in in pipe element and rigid element.





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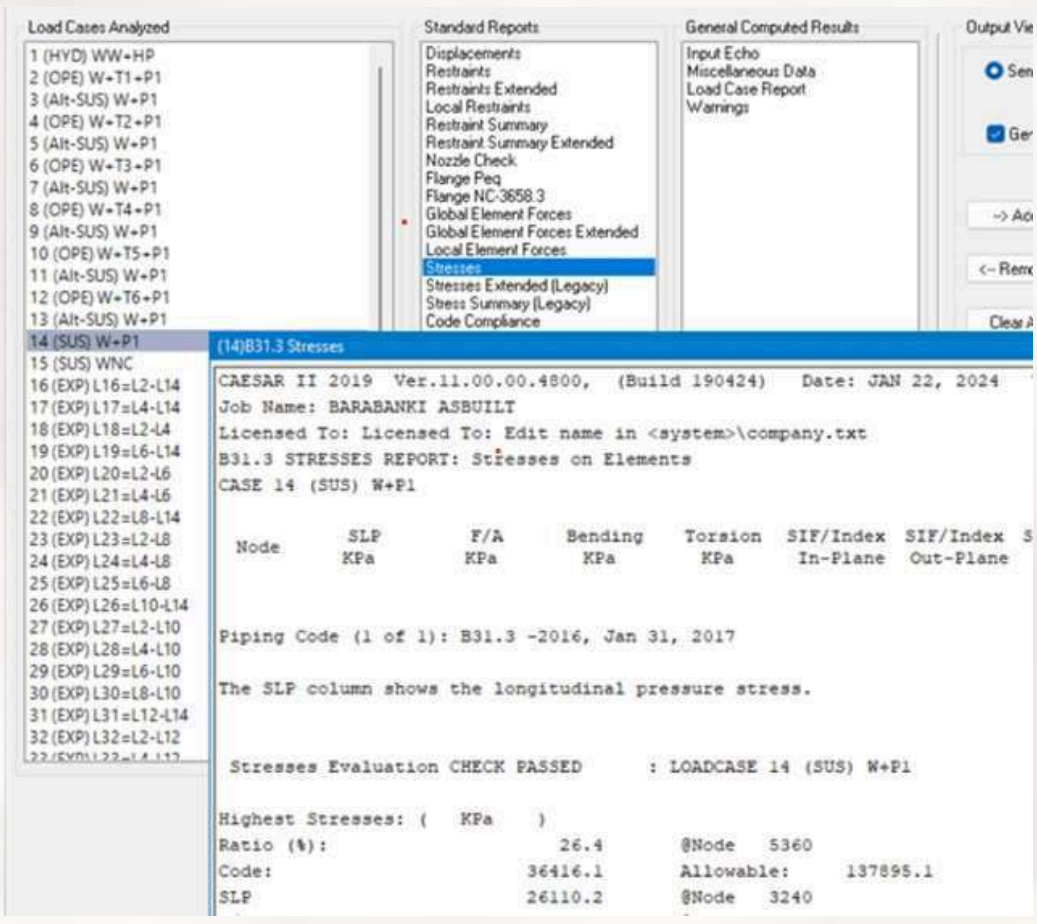
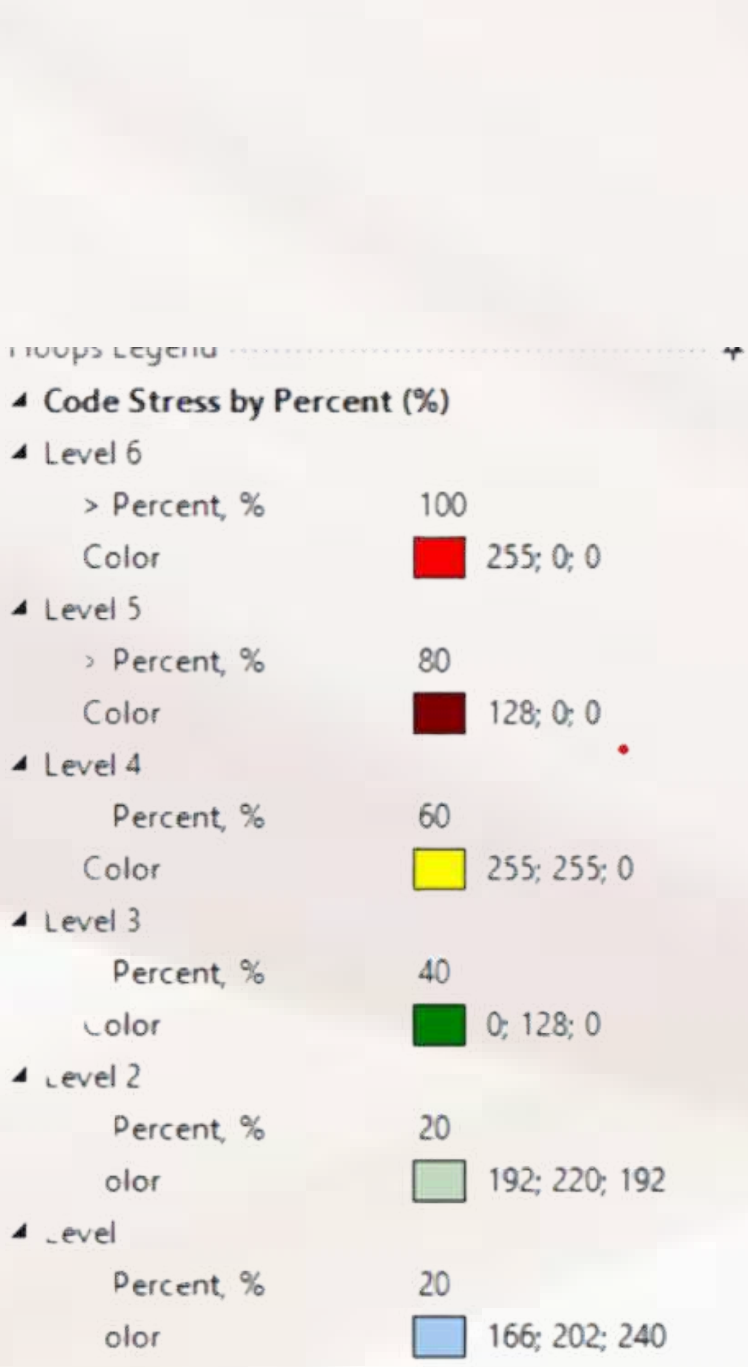
7 CAESAR II Load cases and Results (2 hrs)

Course number 7 is continuation of Course number 5. In Course number 5 we had learnt the theory about the load cases, How to write them, it's combination methods. In this Course we are going to learn how to build the load cases in CAESAR II software.

- What are the different features of this wizard?
- How to make the most out of the various advantages provided by the software.
- How to apply wind, earthquake, forces in the load cases.
- How to interpret the results.
- How to correlate the results with the code.
- How to identify whether liberal stress is on or not.
- How to interpret the positive and negative sign convention in CAESAR II.
- How to backtrack the sources of forces and stresses by integrating the results.





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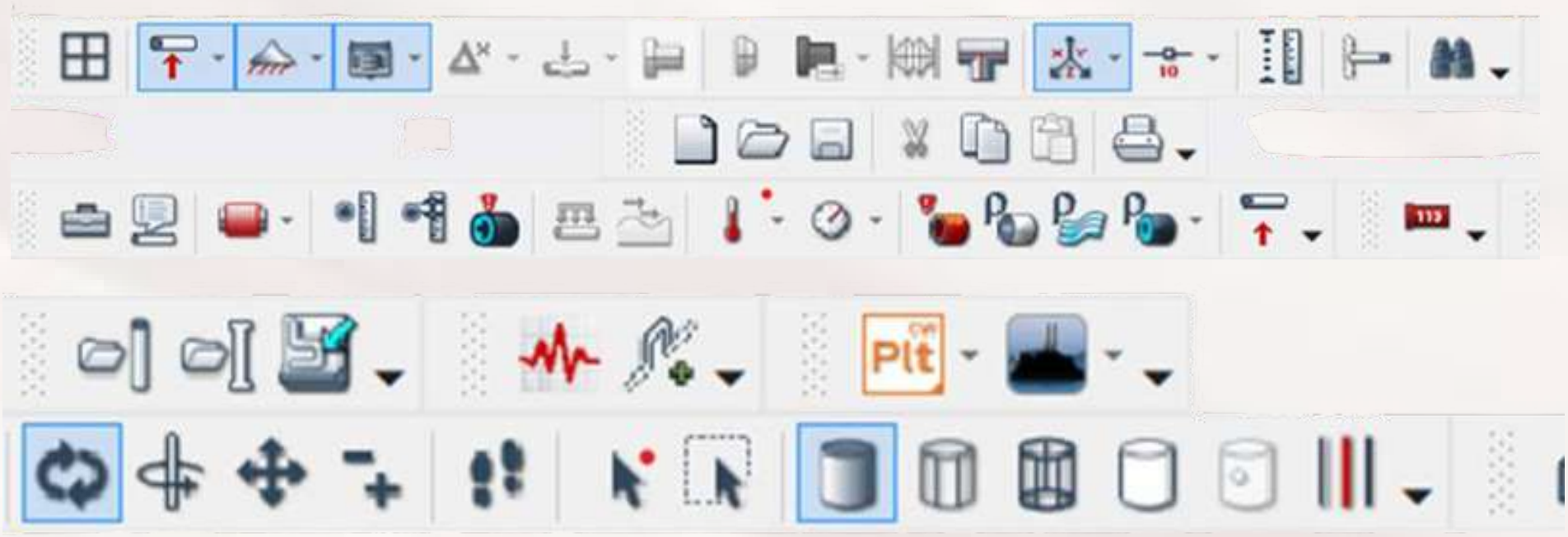
8 Miscellaneous: Modelling, analysis and Results (1 hrs)

After completing Course number no. 1 to 7 successfully now we have reached to a stage where we should start doing experiments. For a stress engineer it is the most essential to keep on trying, doing experiments, make changes into his /her model and look at the results. At the initial stage this 'trial and error' method is very effective to learn the stress analysis. At this stage engineer should start predicting the results of small model and verify it with CAESAR II software. The answers what we get teaches us a lot. This Course has been designed keeping in mind that the listener is new to the software.

- In this model we will learn.
- Study the effects of temperature, supports and layout on the results.
- How to reduce the forces and moments.
- Basic techniques how to solve a stress system, comparing the results.
- Learn few handy commands like Copy, duplicate and rotate.
- Liberal stress and its effect on allowable stress.



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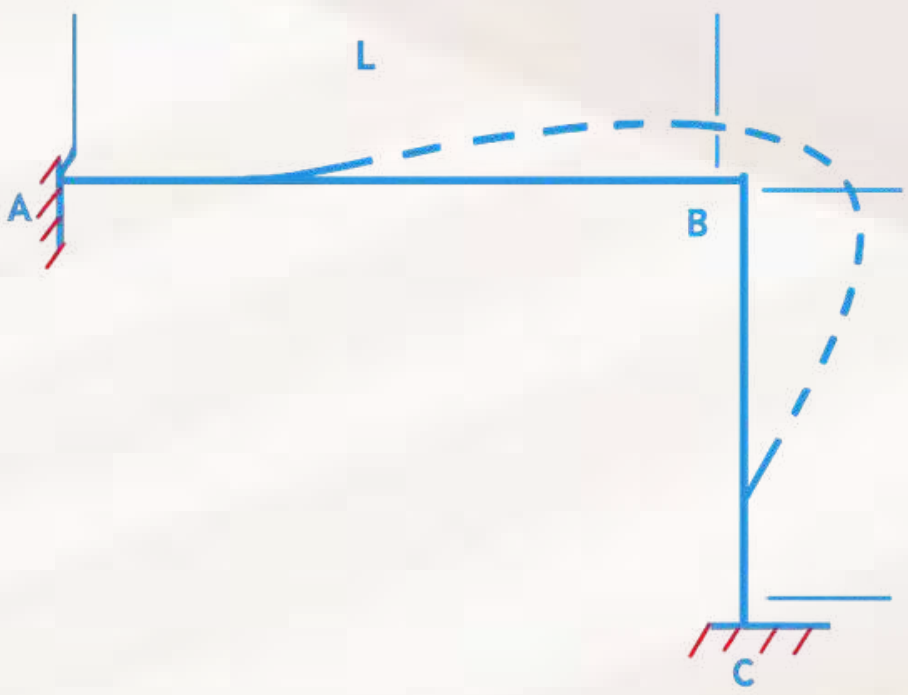
9 Manual Stress Calculation Methods: Span calculation, Guided Cantilever Method and FlexibilitY (2 hrs)

Our trainer strongly believes that when any stress analysis problem comes in front, the solution of that problem should get first formed in your mind. Then one should model it accurately into the software and then look at the results. If the results are as per your predictions then you are on the right track and if not then you can correct your understanding by looking at the results given by the software. In this journey it is very important to know how our ancestors or the previous generation of the engineers used to perform the analysis when they did not have such a sophisticated software. In this Course we are going to learn 'how to calculate SPAN of a pipe' based on 'allowable stress', ' Allowable deflection' and natural frequency. Further we will learn a method called "Guided cantilever method". This method was the basis to determine the minimum required flexibility into the piping system when we had no software. Based on this method number of graph, charts were developed. In this Course we will understand the theory of guided cantilever method, we will solve a problem using hand calculations based on this method and then we will verify the same problem using Caesar II software. We will look into the results and try to compare it with the hand calculation and we will try to learn the accuracy of this method and its limitations as well.



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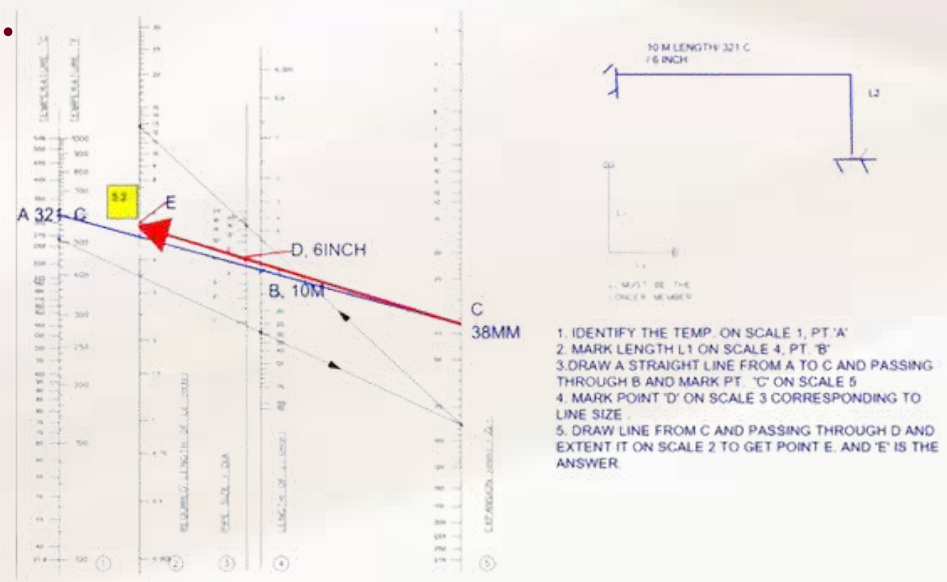
10 **Graphical Methods for Expansion Loop Sizing & Verifying results with software** (1 hrs)

Front End Engineering and Design (FEED) stage or initial stage of detailed piping design, one of the initial deliverable to the site for construction is ‘pipe rack design’. Even it is required to calculate the bulk material take off (MTO). Hence a piping engineer or a stress engineer is always asked to provide ‘the number of expansion loops’ which would be needed for adequate flexibility of the pipes running onto the pipe racks. At this stage we do not have piping isometric or General Arrangement drawings or 3D model. Hence modelling pipe rack piping in the stress analysis software is sometime difficult.

In this Course we will learn-

- To predict the number of loops on a line.
- Calculated the forces and moments on the anchor base using.
- Graphical methods and evaluated them using software results.
- What should be the distance between the two anchor points on the pipe rack.
- What should be the height of the loop.
- what about the sizing a 3D loop (three-dimensional loop)?

We can refer to this Course wherein we have solved an expansion loop sizing problem using nomograph and then we have also demonstrated its validity, limitations, advantages of the graphical method against using an expansion loop sizing Wizard provided in CAESAR II software. This Course is extremely useful for Piping design engineers, Piping designers, Project managers and of course for stress engineers.



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11 Pipe supports and their applications (2 hrs)

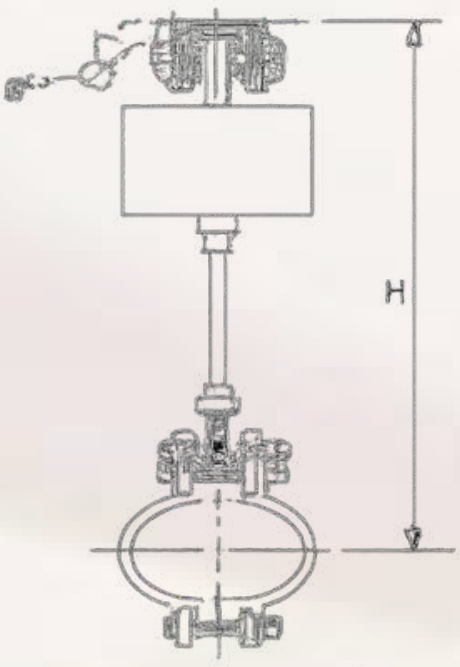
The final outcome of the extensive stress analysis is nothing but ‘IFC isometric’ which means ‘Issued for construction’ isometrics. In these isometrics we get a final pipe route and type of supports which have been approved and recommended by the stress engineer. Here all the wisdom, knowledge and experience of a stress engineer gets converted into the selection of right type of supports.

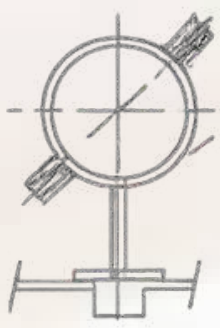
There are various kinds of supports such as rest supports, guide supports, limits stops, springs, snubbers, Struts. Each support has got its own unique features. Hence understanding the language of stress analysis software and then converting them into a appropriate support is very essential.

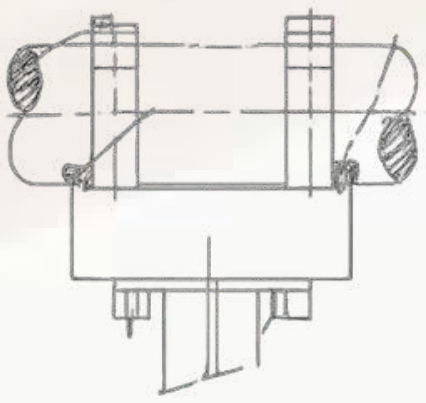
In this Course we are going to learn-

- Different types of supports, their applications.
- Where to use which type of support.
- Do's and don'ts about support.
- How to read arrow marking on stress iso and converting it in physical supports.
- Simple supports and few complicated supports.
- Primary supports and secondary supports.

This Course is useful for piping engineers, designers, stress engineers, mechanical contractors at site and civil engineers.







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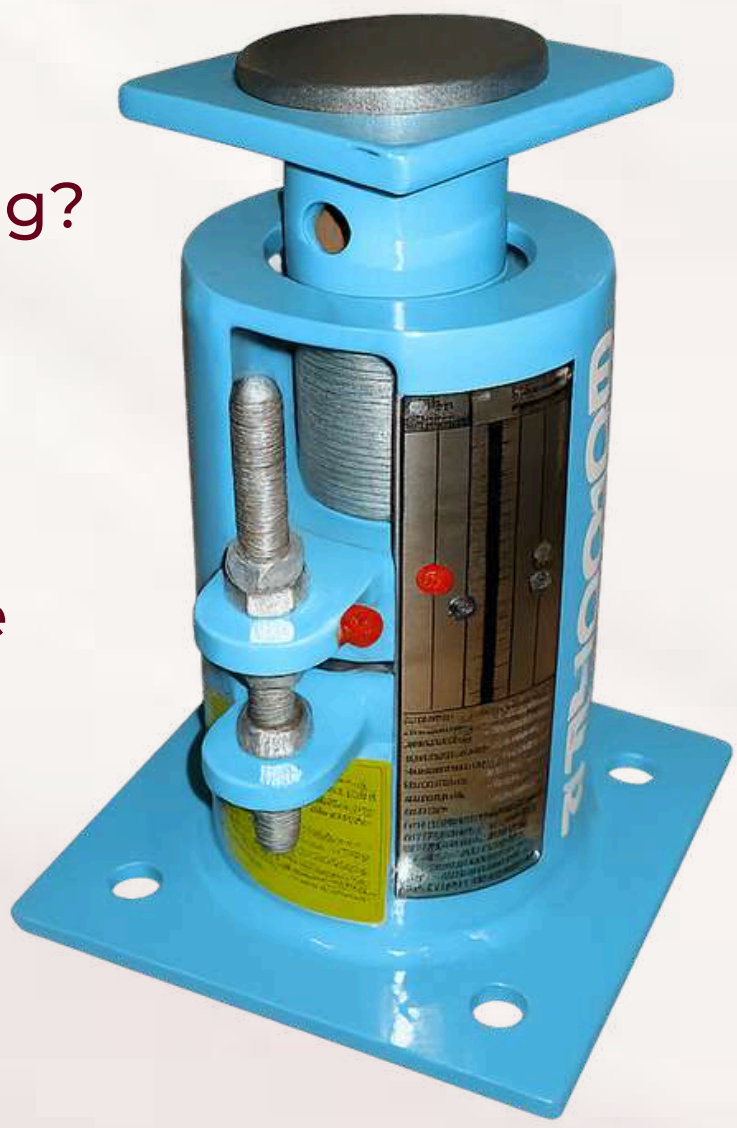
12 Variable Spring Design (3 hrs)

Few piping Engineers and stress engineers do think that the springs are provided in the piping system to absorb the expansion of the pipe. However, this is not the complete truth. The use of spring hanger is mainly to take the dead weight of the Pipe and to allow if free expansion. Most of the times engineers, by experience, do know where and when to use the spring support. But they cannot select the string without the help of the software. Also, they struggle to select this spring from the vendor catalogue. Further they find it difficult to give a decision whether we can use a spare spring which is available in the stock /inventory at a particular place. To give these decisions the concept of variable spring, hot load, cold must be clear in mind.

In this Course we will learn-

- what is Hot load ?
- what is Cold load?
- what is Variability of the spring?
- How they are co-related
- What is cold load setting?
- what is hot load setting?
- what is extended load range?
- How to read Spring catalogue
- How to select spring from catalogue
- Various entries of spring Wizard in detail
- How to write the ‘Load cases’ with spring.



Also, we will perform hand calculations and will verify them using Caesar II software.

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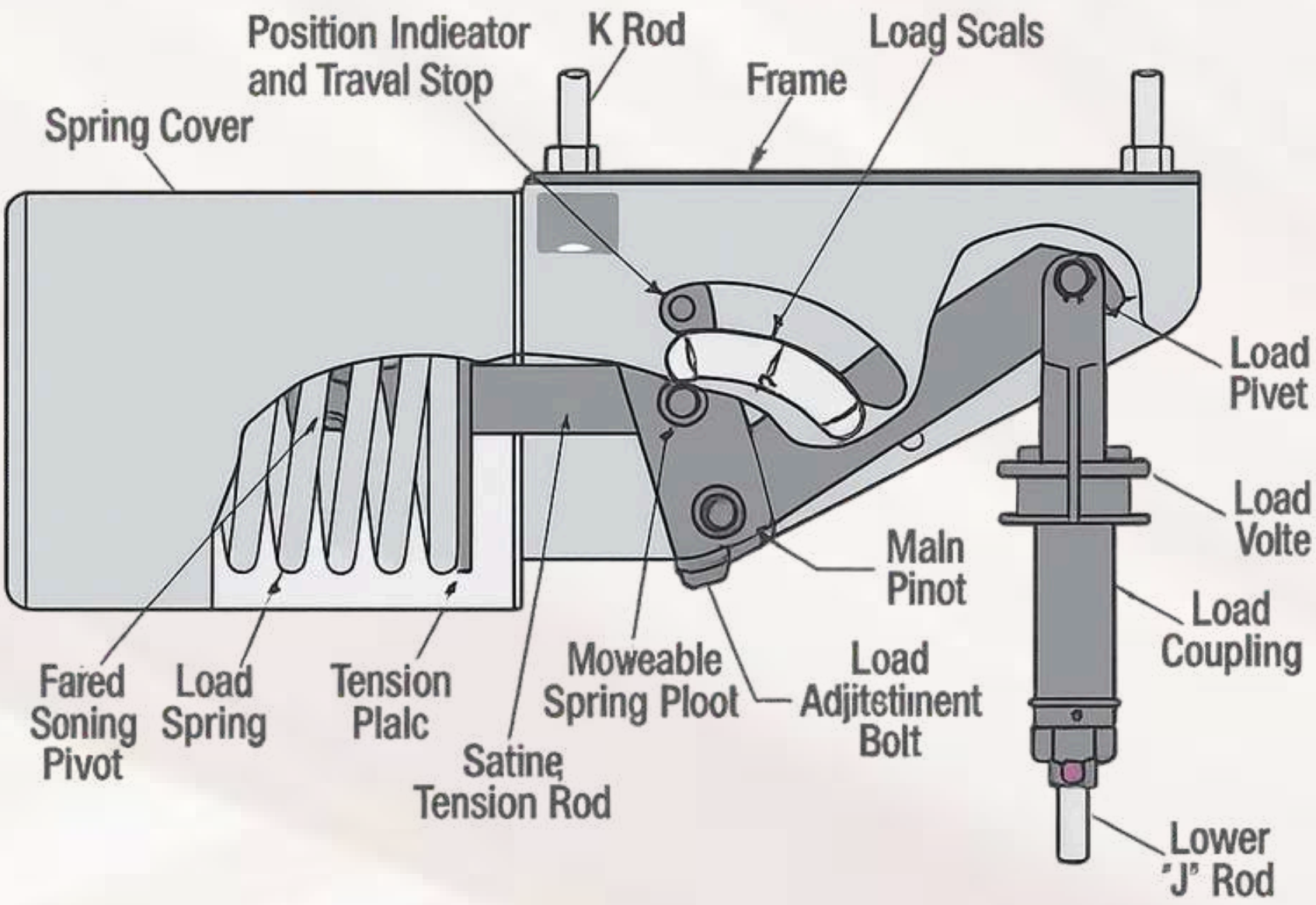
13 Constant Effort Springs (1 hrs)

When it comes to 'Constant efforts spring', most of the engineers step aback. There is a kind of 'suspense' in the design and usage of constant effort spring due to lack of information.

In this Course we will attempt to learn-

- How constant effort spring works.
- Understand its internal mechanism in a simple way.
- The mathematics involved in it.
- Learn to read vendor catalogue.
- How to select a constant of a spring through it.
- How to write the load cases.
- Will perform the a practical & verify our theory against the results obtained.



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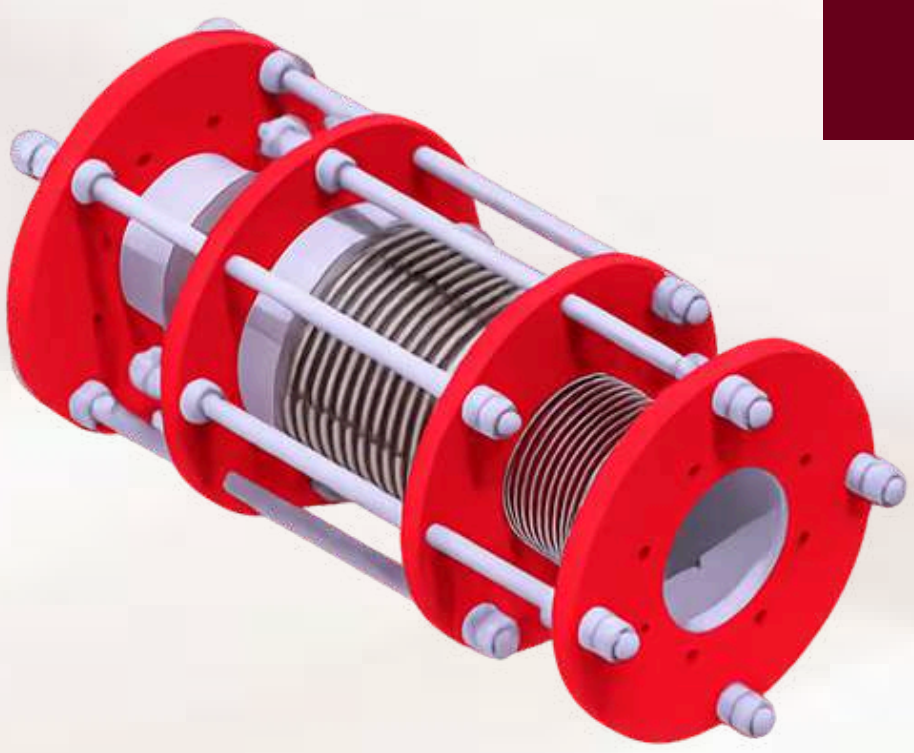
14 Expansion Joints: Types & applications (3 hrs)

Most of the piping engineers and stress engineer work in downstream Oil & Gas industry or in refinery piping. But in hydrocarbon service the usage of expansion bellow is prohibited. Due to this reason most of the stress engineers do not get exposure to work with Expansion joints or bellows. This makes it a grey area for them. There are various kinds of bellows such as fabric bellows, rubber bellows, metallic bellows. Each type of bellow has its own advantages and disadvantages. Further in each type, for example in metallic bellows, there are sub types such as Tied bellow, untied bellow, pressure balanced bellow etc.

In this Course we are going to learn-

- The different types of Expansion joints.
- Pressure thrust due to bellow.
- How to eliminate it.
- Tied bellow, untied bellow, pressure balance bellow.Expansion joint wizard in CAESAR II.
- How to read the catalogue of expansion joint.
- How to select the below.
- How to model a pressure balance below.

This Course is useful for piping engineers, engineers at site and stress engineers who wish to learn the Expansion joints.



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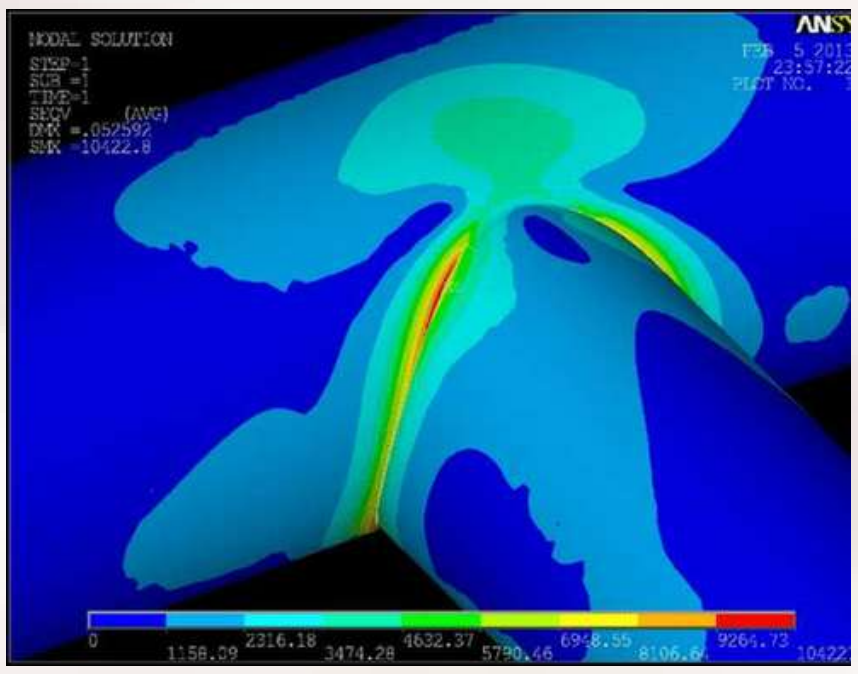
15 Stress Intensification Factor & Flexibility (1 hrs)

Stress Intensification Factor also known as SIF is a topic of research and probably the least understood subject in Pipe Stress Analysis. We do not claim to be master of this subject. But definitely would like share the information we have in this domain.

In this Course we will learn-

- What is flexibility factor?
- What is SIF?
- How to calculate it using appendix D of ASME B31.3.
- The limitations of ASME B31.3 appendix D.
- Markl's work in SIF.
- An overview of Finite Analysis method to get SIF.
- The myths and truths about SIF.
- How SIF is used in stress equations.
- Should we consider SIF in Sustained and occasional cases?
- Mitre bends and its SIF.
- How flexibility of the bend changes with its connection to flanges.
- Discussing technical paper authored by the faculty.



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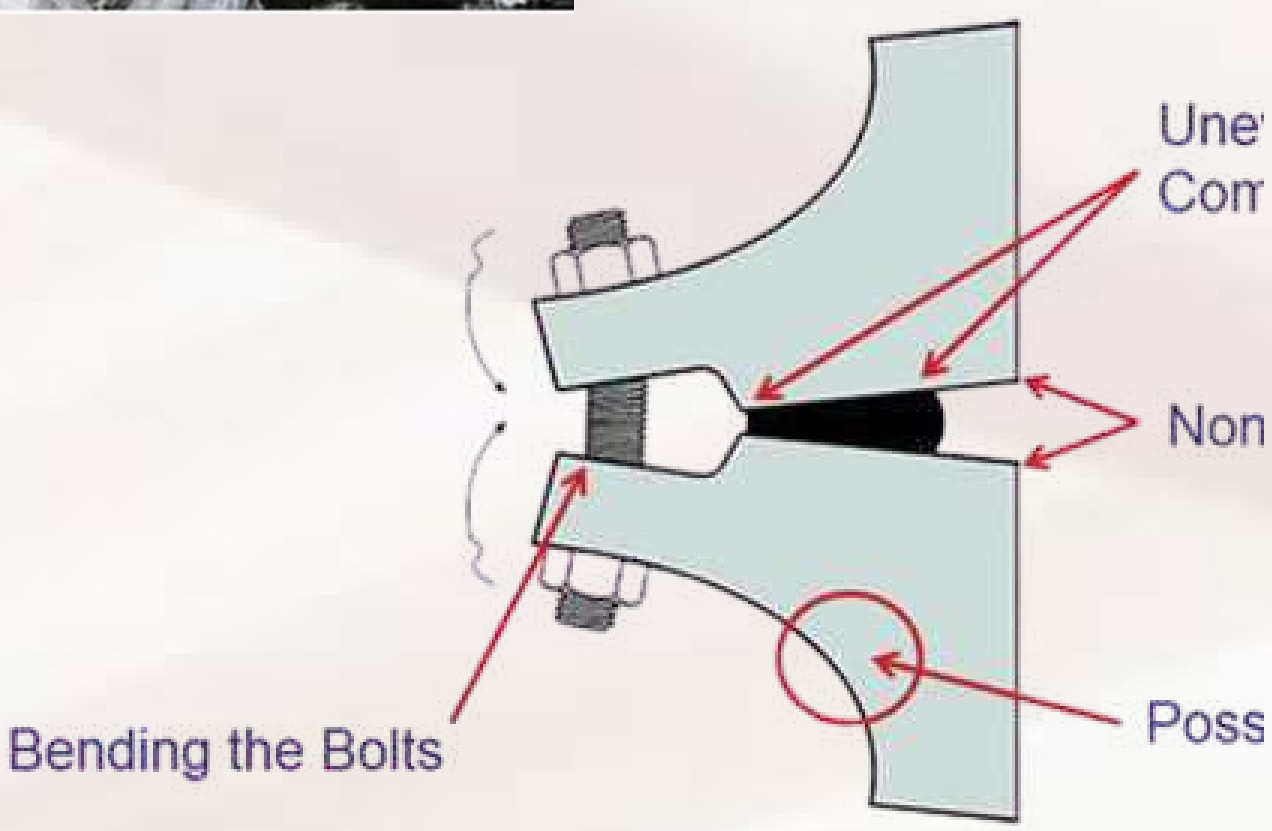
Course Content

16 Flange Leakage Analysis (2 hrs)

Flange leakage is one of the critical safety aspects. Even though it is practically impossible to give guarantee that flange would not leak (as it depends on various other factors as well), there are industry approved practices to ensure Flange Leak would not happen.

In this Course we will learn-

- Pressure equivalent method and manual calculations.
- NC 3658 method manual calculations.
- Verifying CAESAR II results against hand calculations.
- Understanding the basics of why flange leak.
- ASME Section VIII method input in CAESAR II.
- ASME section VIII method manual calculations.
- Reference documents from flange leakage analysis.
- Supporting to avoid Flange leakage.



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Course Content

17 **Stress critical lines /system formation / stress report / Stress isometrics** (3 hrs)

After completing all these Courses now we have come to the stage to understand how the work flow is in real life. How engineers in consultancies work. This Course though looks simple but extremely important for junior engineers who would become an asset to the company if understood the work flow from day one.

In this Course we will learn-

- How to identify stress critical lines.
- How to make critical line list.
- Documents needed to form a system.
- How to form a Stress System.
- Where to break the systems.
- What to read in reference documents?
- how to extract report from CAESAR II.
- How to prepare stress isometrics.
- How to select and call support from support standard.
- How to write a good stress report.

		Normal Operating Conditions								Line Information				Design Conditions				Field Test				
CLASS as per DD	Revised CLASS	Mass Flow	Volume Flow		WT	Press	Temp	Vac.	Dens.	Vel	D P	Eff.	Total	UPSET		Code		Test Press.			PNT	PWHT
		Kg/hr	Quan.	Unit	% Vapor	Bar Gauge	°C	C.F.	Kg/m³	m/sec	Bar per Km	Length m	D P Bar	Press Bar G.	Temp °C	Press Bar G.	Temp °C	Bar G.	Medium	Type		
~~C~~	C	88377	1783	m3/hr	100	49.7	24	0.01	49.6	6.12	0.36	24	0.7	53.4 / FV	-10/315			80.1	WATER	H		YES
C	C	88103	1805	m3/h	100	49.3	25	0.013	48.8	6.2	0.36	24	0.72	53.4 / FV	-10/315			80.1	WATER	H		YES
C	C	88103	1805	m3/h	100	49.3	25	0.013	48.8	6.2	0.36	24	0.72	53.4 / FV	-10/315			80.1	WATER	H		YES
C	C	88377	1783	m3/h	100	49.7	24	0.01	49.6	6.120	0.357	24	0.73	53.4 / FV	-10/315			80.1	WATER	H		YES

Course Content

18 Checking of a Stress calculation & how to read stress analysis report (2 hrs)

If you are an engineer representing client or PMC (project management consultant) or a lead stress engineer and your job description demands to check the stress calculation / report then this Course is for you. In fact, slowly all the stress engineers have to reach to this phase. Initially he /she has to self-check his/her own system and slowly start checking stress calculations prepared by others. Unfortunately, the checking time of the stress system is rarely given justice in the man hour estimation despite the fact that the 'Checker' is 'responsible' for the quality. In such situation checking becomes 'an art'.

In this Course we will learn-

- Minimum or common check points in CAESAR II model.
- Critical check points.
- How to check the results by applying 'Thumb Rules'.
- How to identify if the analyst has 'cheated or managed the results'.
- How to check hard copy report.
- Common errors.

CHECK LIST	Yes	No	N/A	COMMENTS
1. Axes are marked on all Stress Isometrics	☐	☐	☐	
2. Terminal Movement of Equipment Nozzle calculated / equipment coded w.r.t latest Equipment drg.	☐	☐	☐	
3. Input checked as given below: (Check print to be maintained for Rev 0 and later major revisions only)	☐	☐	☐	
a) Pipe routing	☐	☐	☐	
b) Pipe material, pipe diameter & schedule	☐	☐	☐	
c) Corrosion allowance	☐	☐	☐	
d) SIF's at branches	☐	☐	☐	

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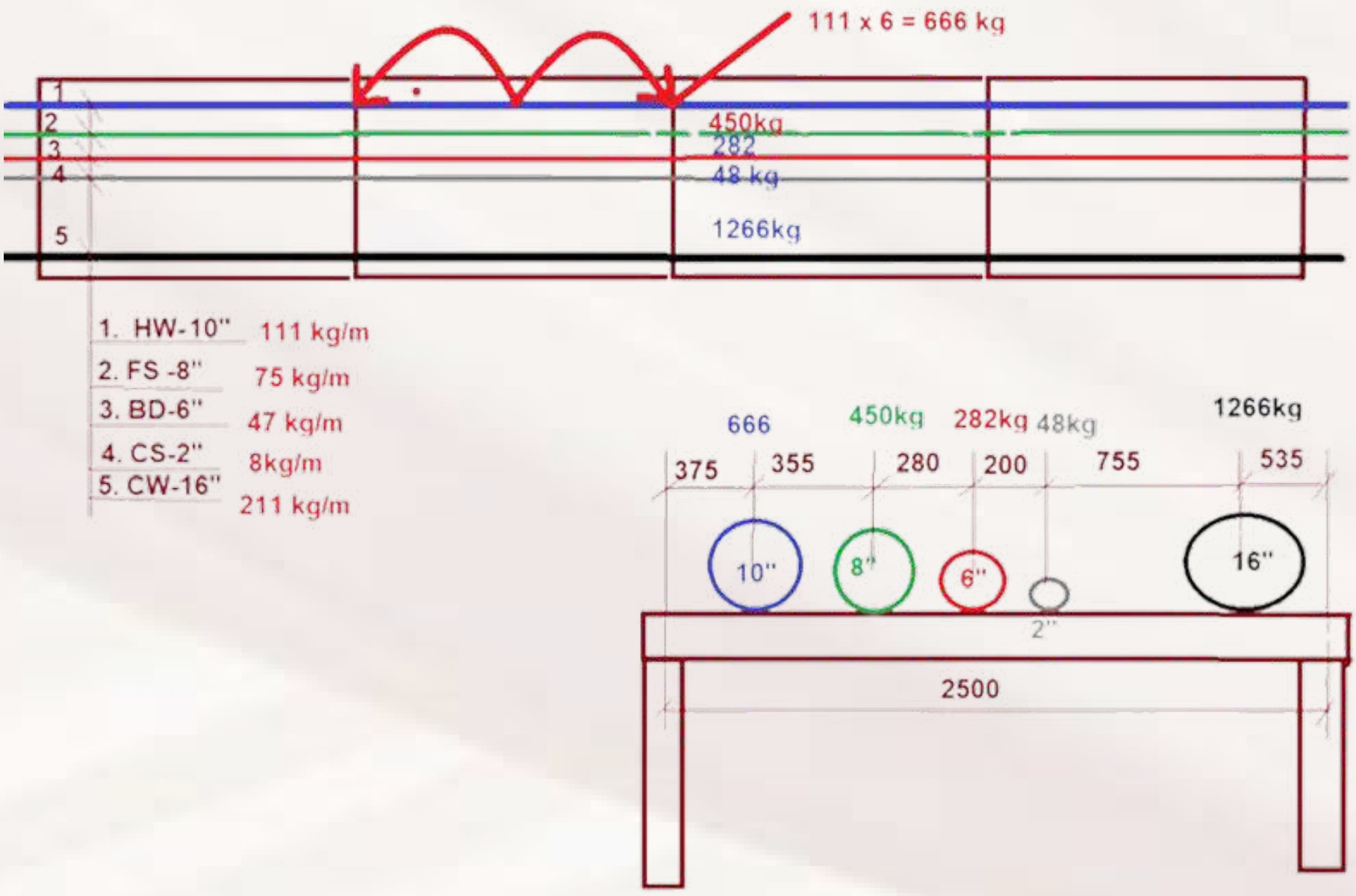
Course Content

19 Pipe rack loading / platform loading (2 hrs)

Many times, at the initial stage of the project when the stress analysis has not started yet you may have to provide the loads (Forces / Moments) to civil engineer to design pipe rack or a platform. This activity is also applicable to Non-stress critical lines. Sometimes piping engineer (who may not be a stress engineer) has to provide these loading without using a software. Hence this Course is extremely useful to piping engineers, piping designers and off course stress engineers.

In this Course we will learn-

- How to give UDL (Uniformly distributed loads).
- How and when to provide Point loads.
- How to calculate minimum axial loads on anchor bay.
- Thumb rules of loading.



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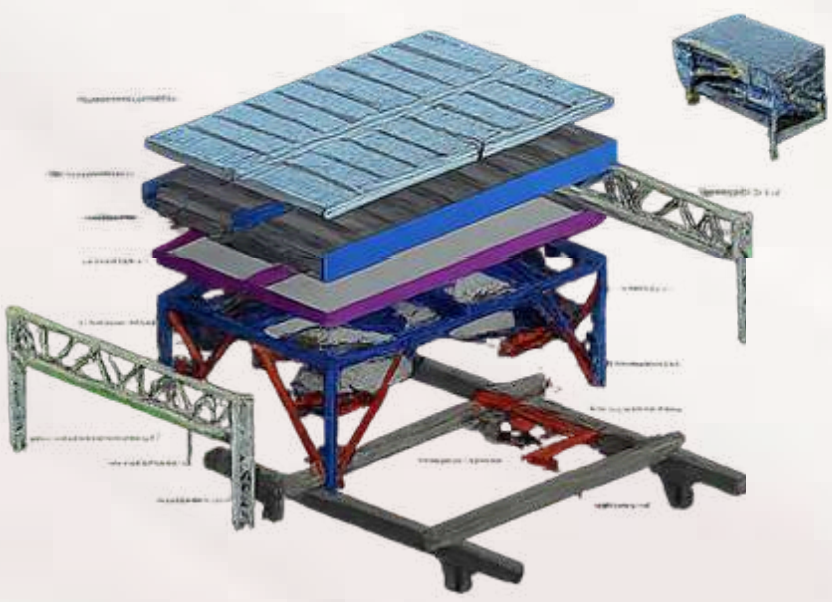
Course Content

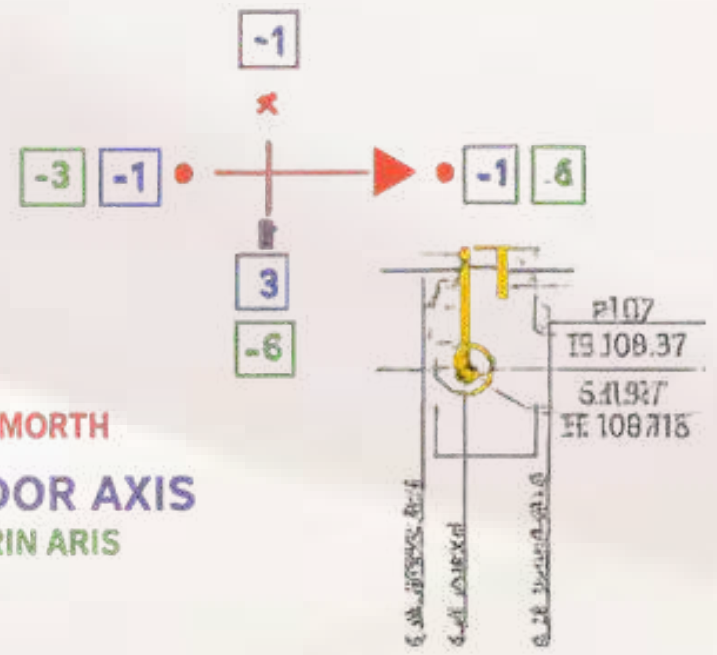
20 Overview of critical systems (3 hrs)

Now we have come to an end of this Course. This is right time to review few critical systems. The participant must understand that it takes nearly 30 to 40 hours to complete one critical system (with 5 to 6 stress critical lines in it) in all aspects. So practically it is not possible to model each and every system in limited time. However, we can review the ready models of such a critical system and the comments on those. Each of these systems have typical behaviour, typical piping route requirements, typical supporting and hence learning it by experts adds in your knowledge.

In this Course we will have overview of-

- Tank Piping.
- Heat Exchanger Piping.
- Column Piping.
- Air Fin Cooler Piping.
- Turbine & Compressor Piping.





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Course Content

21 Introduction to Pipeline Stress Analysis (1 hrs)

This Module introduces you with various aspects of the Pipeline Stress Analysis. It starts with comparison of Piping and Pipeline which identifies the main difference between both. The approach towards Pipeline Stress Analysis is different and must be well understood.

This MODULE covers-

- Pipelines and its failures.
- Difference between Piping & Pipeline stress analysis.
- Pipeline fittings.
- Introduction of Pipe -Soil interaction.
- Restrained Unrestrained sections.
- Water hammer effects on Pipeline.
- Introduction to Seismic wave propagation.
- Pipeline buckling , soil liquefaction etc.

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Course Content

22 ASME B31.3 Code Stress Equations: (2 hrs)

Probably this the most important module of this course which talks in detail about the equations of ASME B31.4 and B31.8. This module discusses the equations of stress calculations in detail, compares both the codes.

The code equations in detail,

- Restrained / Unrestrained Pipeline concept.
- Pipeline thickness calculations.
- External pressure check for pipeline.
- Poisson's shrinkage, pressure elongation, thermal expansion.
- why equations are written in a particular way.
- what is the significance of + and - sign.
- Scope and Exclusions of ASME B31.4 and B31.8.
- Code equations.

Pipeline Transportation Systems for Liquids and Slurries

ASME Code for Pressure Piping, B31

Gas Transmission and Distribution Piping Systems

ASME Code for Pressure Piping, B31

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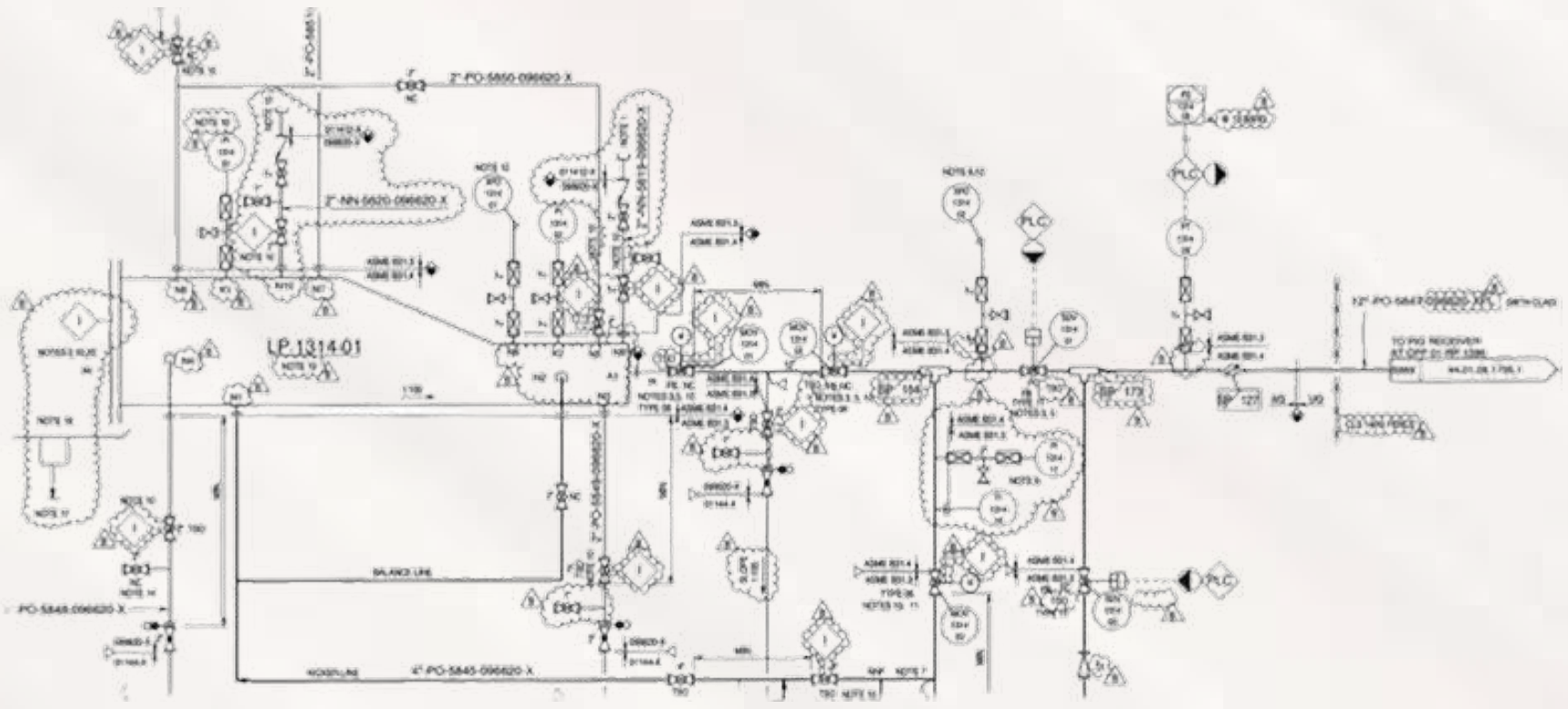
Course Content

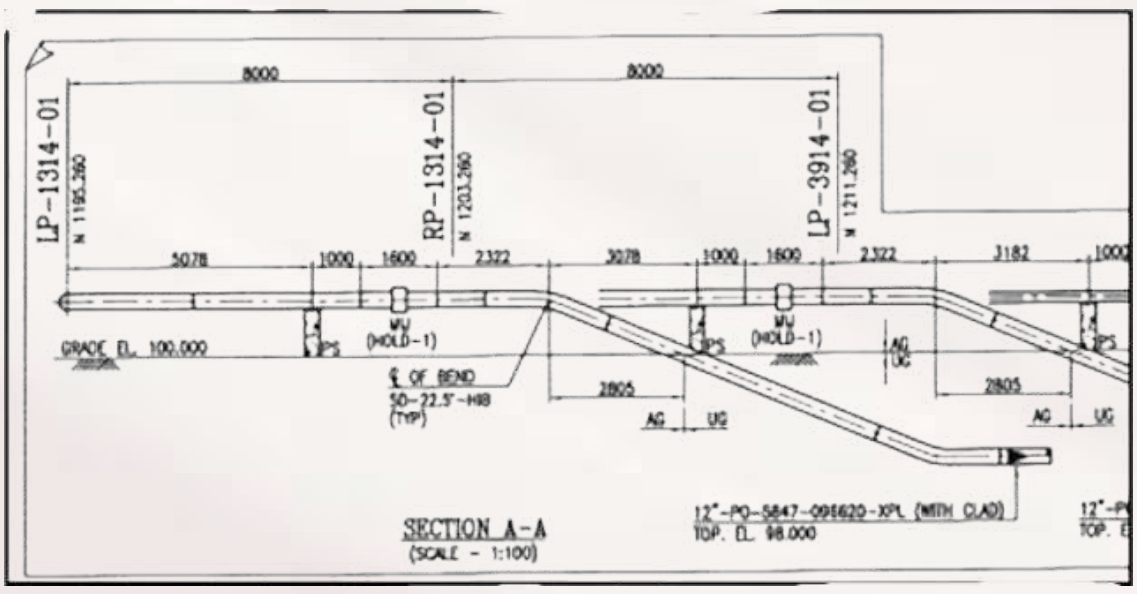
23 How to read Pipeline Documents? (2 hrs)

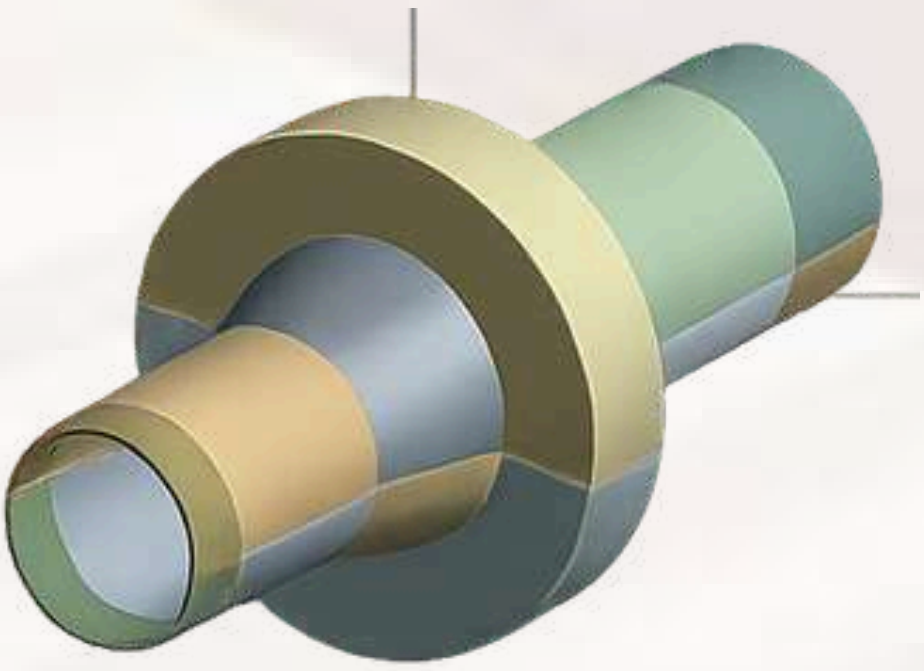
This module explains in detail how to read the Pipeline related documents and interpret them to create the CAESAR II model quickly.

In this MODULE we will learn-

- Key points in Pipeline Design Basis.
- Alignment sheets.
- Pipeline P & ID.
- Station Approach Drawing.
- Monolithic Insulation Joint.







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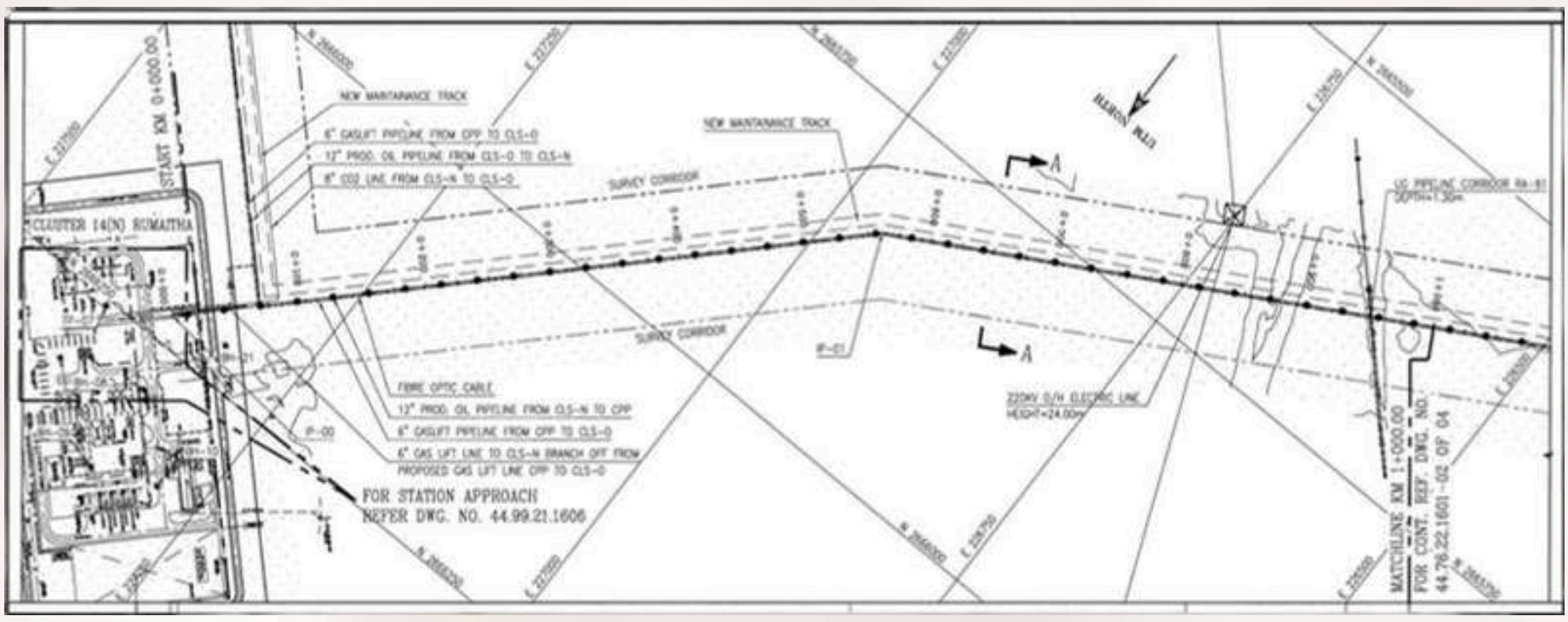
Course Content

24 Pipeline Modelling Techniques using CAESAR II (2 hrs)

This module is continuation of the previous model where we learn how to create a CAESAR II model accurately and quickly. This module is a case study where Pipeline model along with launcher and receiver, MIJ is shown using CAESAR II software.

12" PROD. OIL PIPELINE FROM CLS-N TO CPP				
IP	EASTING	NORTHING	NEW-X	NEW-Z
IP-00	227356.68	2666228.352	-396532	-396532
IP-01	226960.148	2665831.82	-567385	-317392
IP-02	226392.763	2665514.428	9278	-16586
IP-02A	226402.041	2665497.842	40421	-41533
IP-02B	226442.462	2665456.309	328743	-587676
IP-03	226771.205	2664868.633	-134214	-773646
IP-04	226636.991	2664094.987	465588	-365159
IP-05	227102.579	2663729.828	29922	22460
IP-06	227132.501	2663752.288	18460	-14479
IP-07	227150.961	2663737.809	131292	-34676
IP-08	227282.253	2663703.133	63286	-28021
IP-09	227345.539	2663675.112	53501	-37572
IP-10	227399.04	2663637.54	77168	-77168
IP-11	227476.208	2663560.372	-227476208	-2663560372



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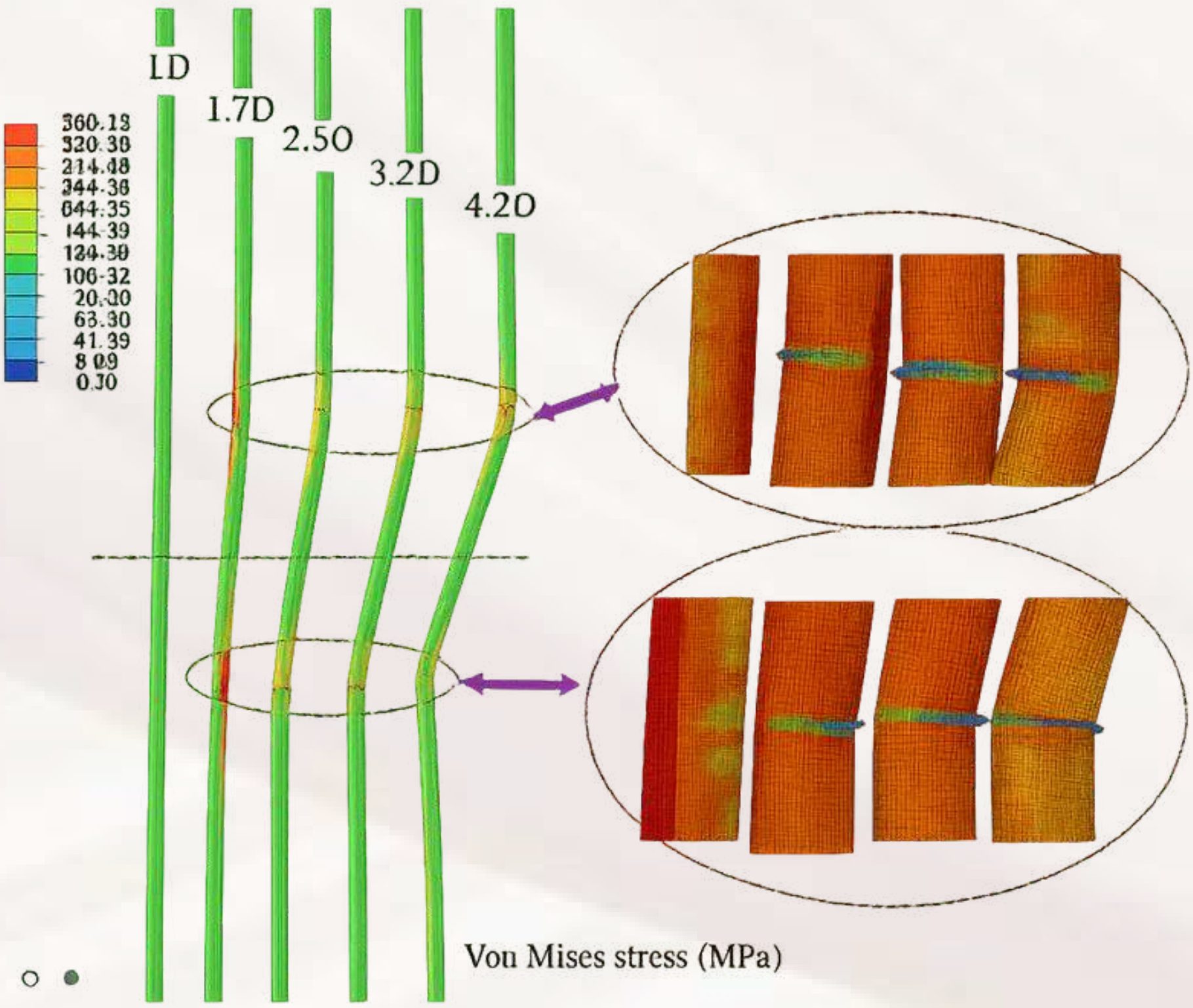
Course Content

25 Pipeline Analysis and Results interpretation (1 hrs)

After completing MODULE number no. 1 to 9 successfully now we have reached to a stage where we should start doing experiments. For a stress engineer it is the most essential to keep on trying, doing experiments, make changes into his /her model and look at the results. At the initial stage this 'trial and error' method is very effective to learn the stress analysis. At this stage engineer should start predicting the results of small model and verify it with CAESAR II software. The answers what we get teaches us a lot. This MODULE has been designed keeping in mind that the listener is new to the software.



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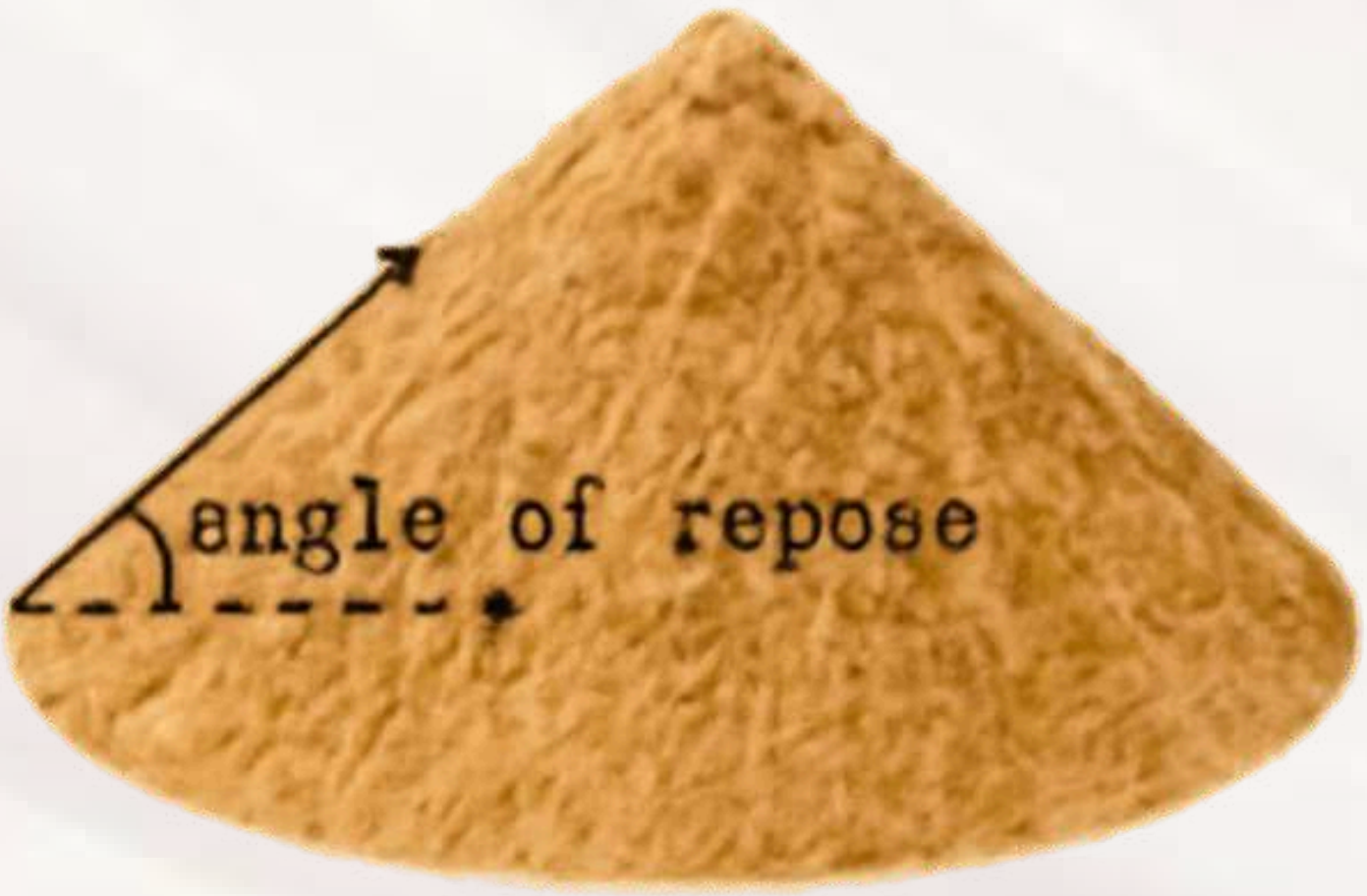
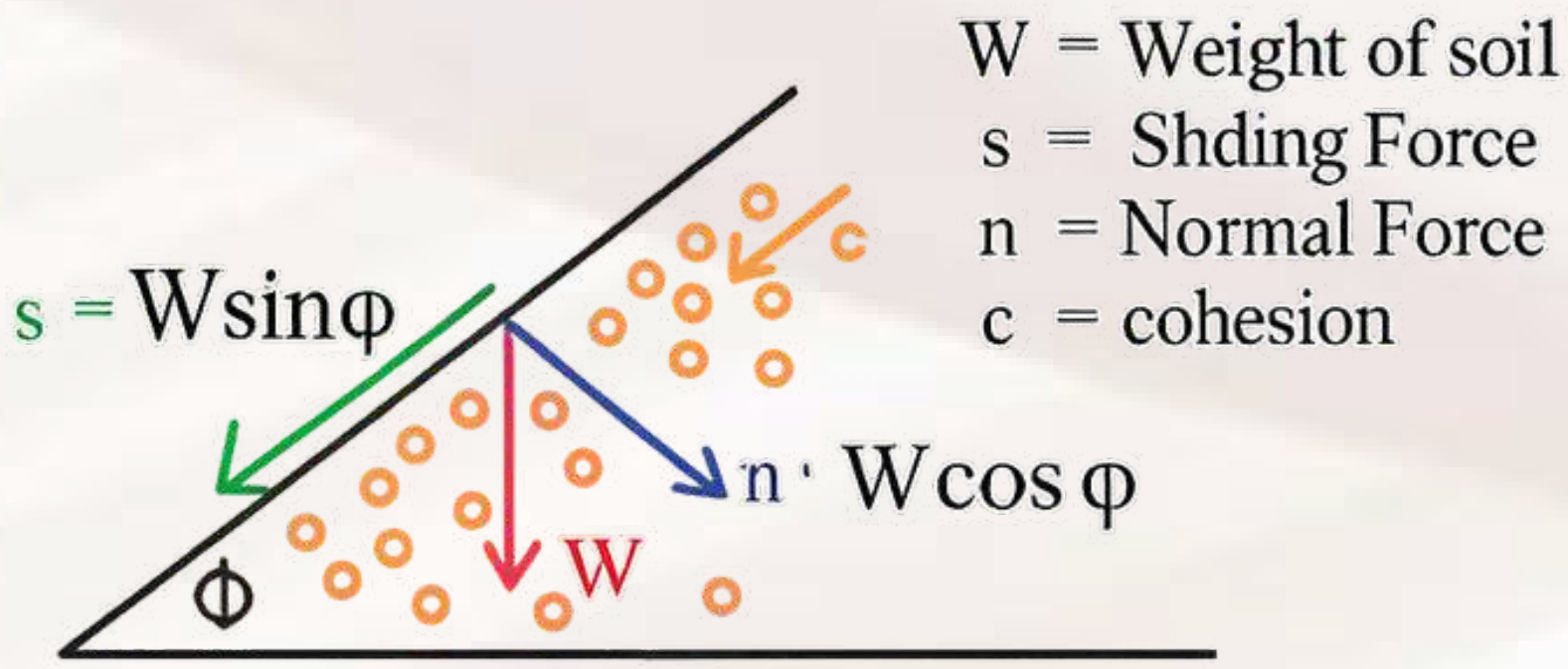
Course Content

26 Understanding Soil-Pipe Interaction (3 hrs)

Most of the Stress Engineers either hold Mechanical engineering or sometimes Chemical engineering degree. Both these streams do not deal with Soil properties in their curriculum. Hence, when it comes to analyse buried Pipeline many of the terms and concepts such as Soil types, cohesive pressure, friction angle etc are not known to the Stress Engineer. Buried module of the software is also known only to the extended of 'Data Entry'. In this module we cover

- Overview of buried Pipe behaviour.
- Soil properties and their significance.
- CAESAR II buried module- Basic method and ALA method.
- Comparison between above two methods.
- Discussion on Technical paper.





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Course Content

27 Pipeline Manual Calculations (3 hrs)

Our trainer strongly believes that when any stress analysis problem comes in front, the solution of that problem should get first formed in your mind. Then one should model it accurately into the software and then look at the results. If the results are as per your predictions then you are on the right track and if not then you can correct your understanding by looking at the results given by the software. In this journey it is very important to know how our ancestors or the previous generation of the engineers used to perform the analysis when they did not have such a sophisticated software.

In this MODULE we are going to learn-

- Pipeline Thickness Calculations as per ASME B31.4.
- Pipeline Thickness Calculations as per ASME B31.8.
- Pipeline thickness calculations for External Pressure.
- Buoyancy calculations.
- Anchor Force Calculations.
- Virtual anchor length calculation.
- Support Span Calculations.

SPAN IS SELECTED MINIMUM OF FOLLOWING

BASED ON LIMITING STRESS	BASED ON ALLOWABLE DEFLECTION	BASED ON NATURAL FREQUENCY
L_S = SQRT ([Sh / 2] x [Z/ 1.375 W])	L_d = (Δ E I / 18 W)$^{0.25}$	f_n = 1 / 2Π (g / Δ)$^{0.5}$
L_S = Span based on stress, ft Sh = Allowable Stress, PSI Z = Section Modulus, in3 W = weight of Pipe, lb/ ft	L_d = Span based on deflection, ft Δ = allowable deflection, in E = Modulus of Elasticity, PSI I = Moment of Inertia, in^4 W = weight of Pipe, lb/ ft	f_n = Frequency , Hz g = gravitational acceleration, 386 in/ sec^2 Δ = maximum deflection, in

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Course Content

28 Seismic Analysis of Buried Pipeline (2 hrs)

Like Soil properties, Mechanical engineering also does not deal with Earthquake or Seismic event. Predominantly we take the data from Civil engineers such as base shear or seismic acceleration (co-efficient) in terms of Gravity acceleration 'g'. However, when the cross country pipelines traveling through seismic zone we need to perform 'Strain Based analysis' due to Seismic Wave propagation. This module covers.

- Limitations of Software to perform Seismic analysis for Buried pipeline.
- Basics about Earthquake.
- Types of Seismic Waves.
- Boundary separation of tectonic plates.
- Faults types.
- Seismic wave propagation calculation.

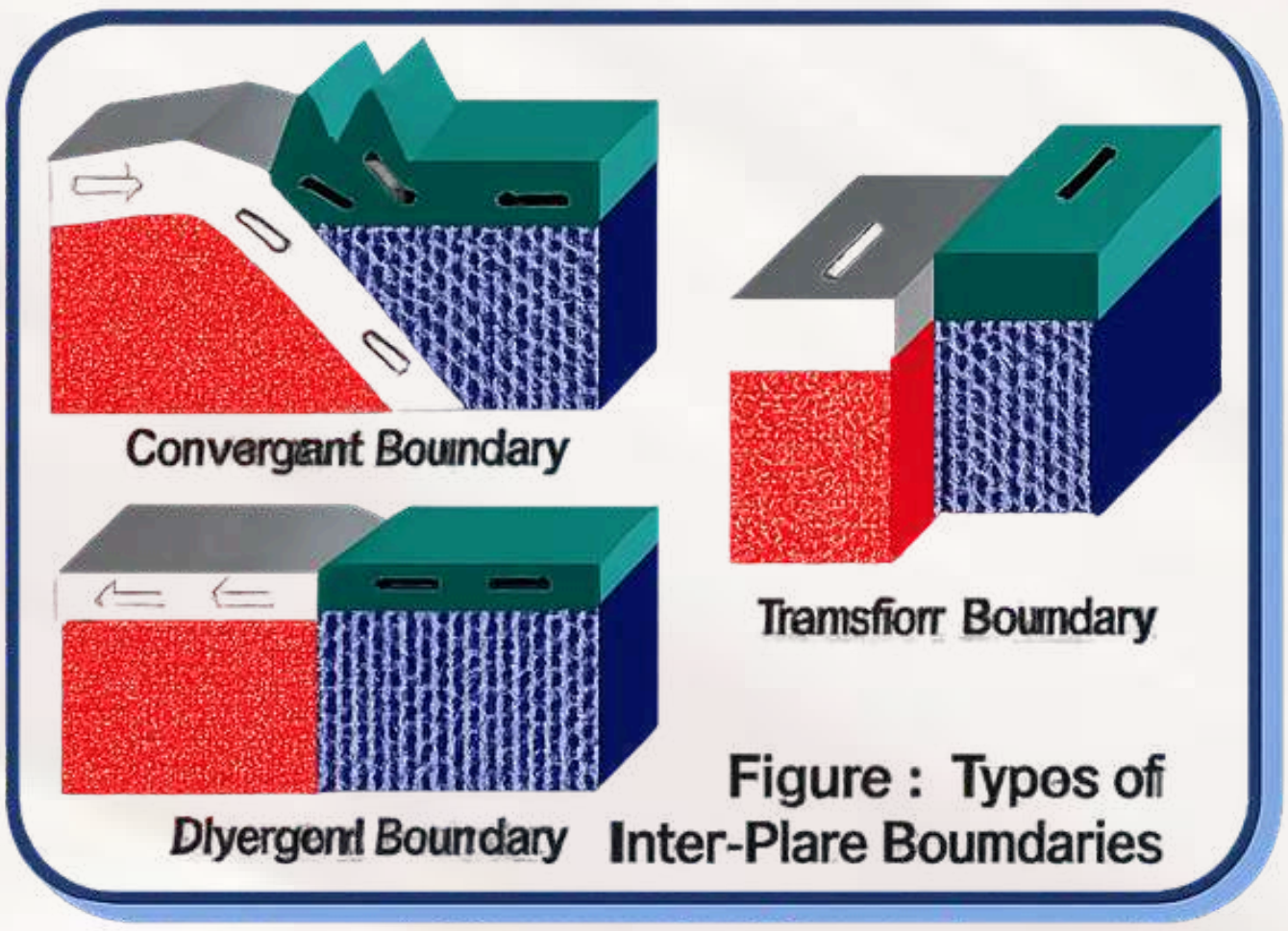
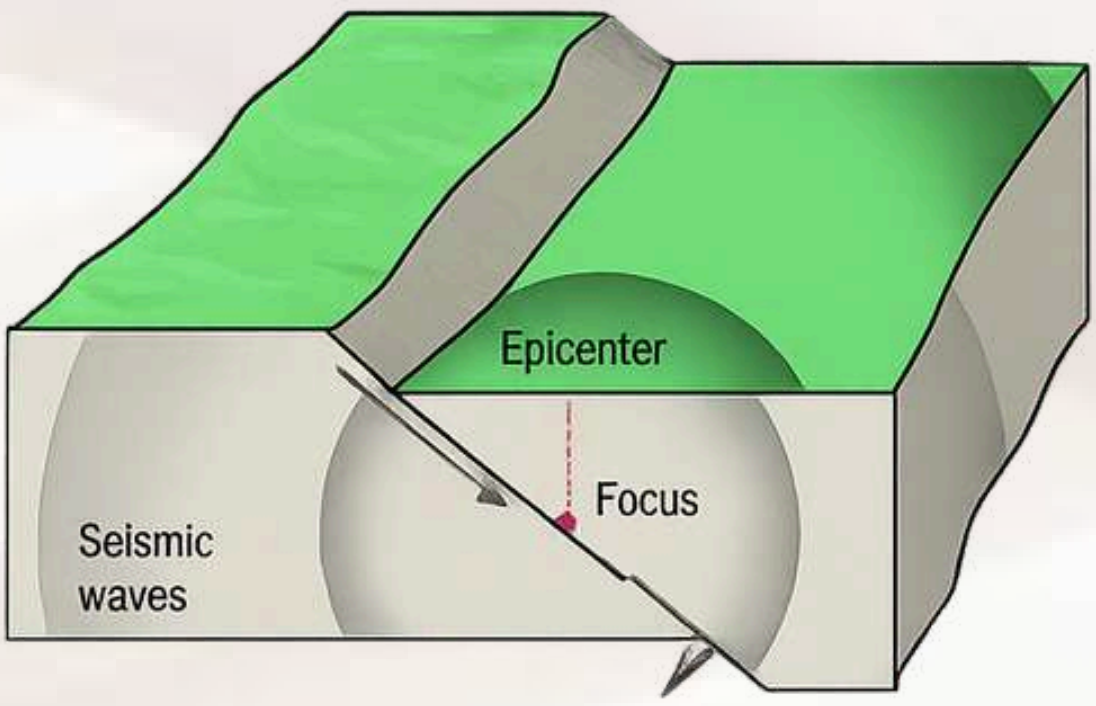


Figure : Types of Inter-Plare Boumdaries



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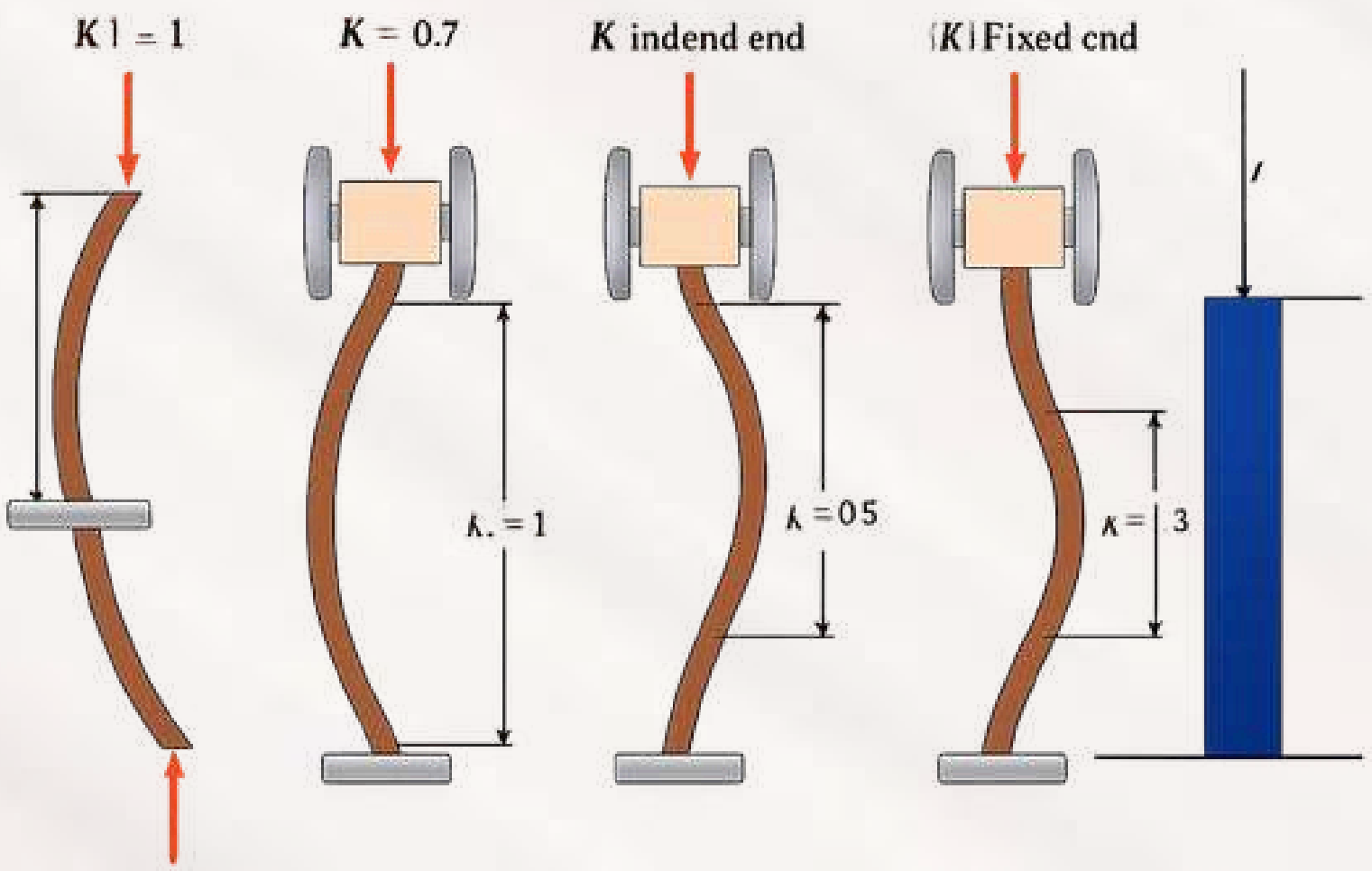
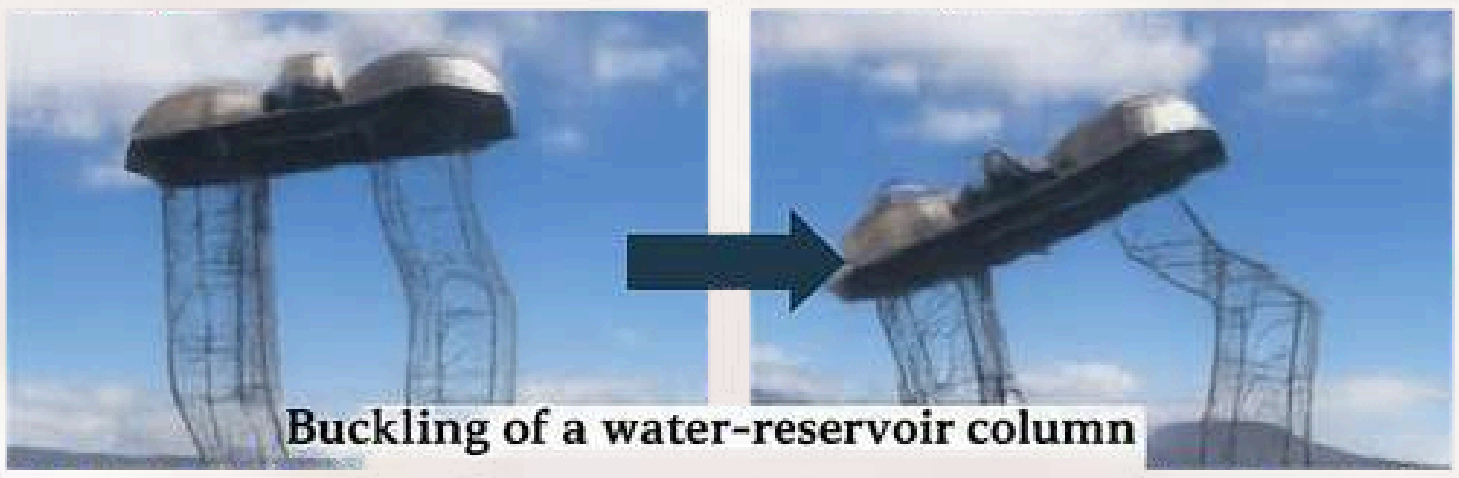
Course Content

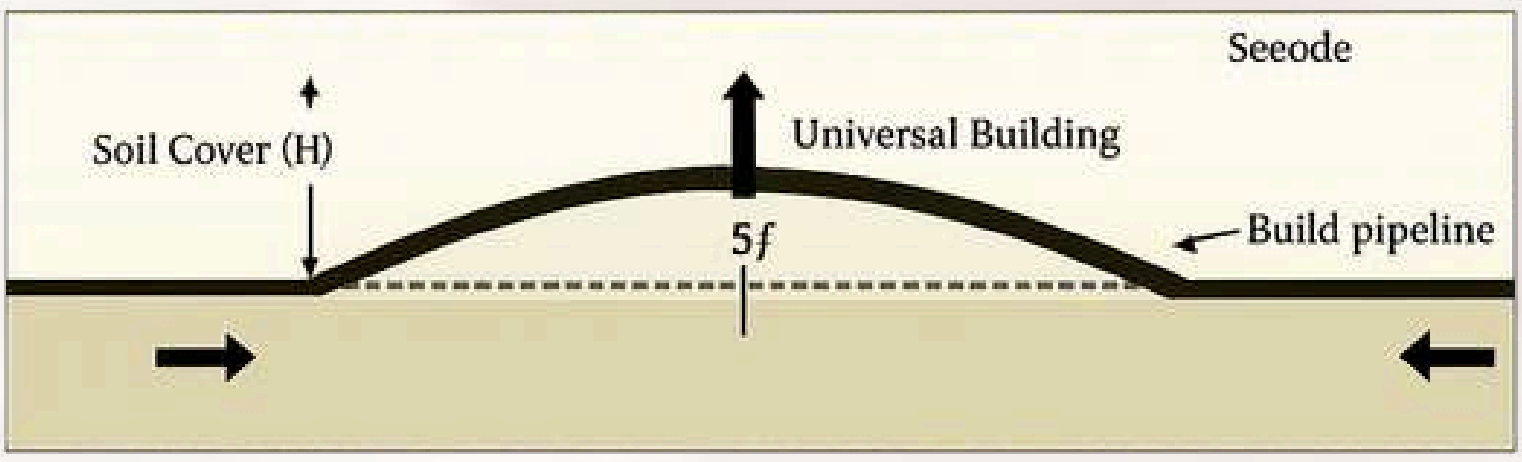
29 Advance Pipeline Calculations (2 hrs)

In addition to manual calculations covered above, pipeline engineer also have to perform few Advance calculations due to limitations of the beam element software and to avoid FEA Pipeline penetration resistance calculations Upheaval buckling calculations methods due to high cost and time. In this module we cover.

- Pipeline penetration resistance calculations.
- Upheaval buckling calculations.
- Crossing (Road / Rail) calculations.




Buckling of a water-reservoir column



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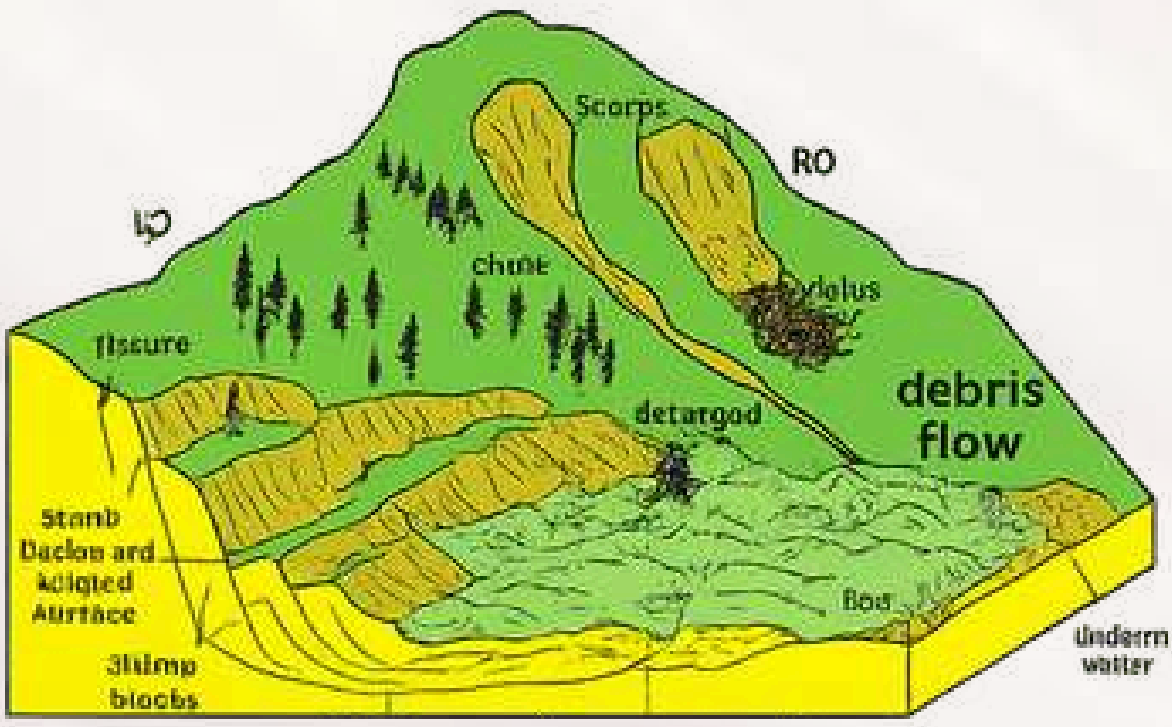
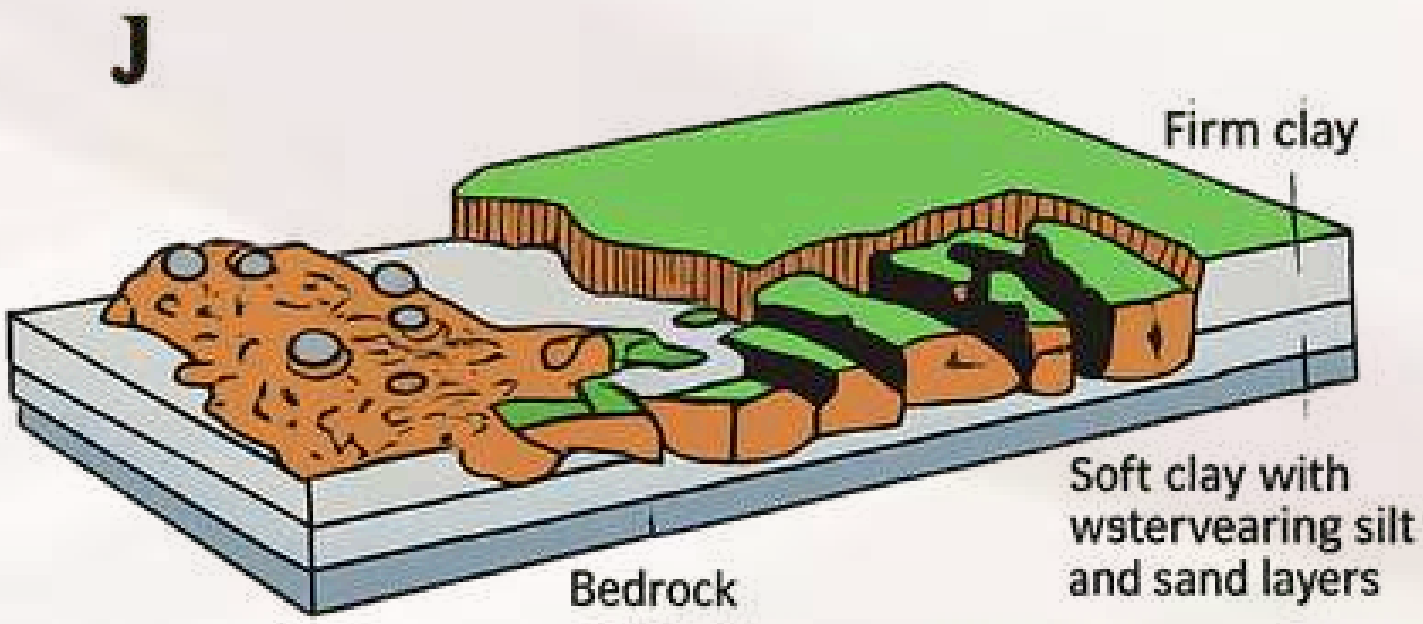
Course Content

30 Pipeline Hazards & Mitigations (2 hrs)

Beyond the Pipeline Stress Analysis and Calculations, a good Pipeline engineer should also be aware about the Hazards which Pipeline might experience based on terrain through which Right of Way passes. Though Geo-specialist / Civil engineers deals with these Hazards, this module discusses following Geo-Hazards.

- What is Geo-Hazard.
- Landslides.
- Soil Liquefaction.
- Lateral Spread.
- Fault / Fissures.
- Blasting.
- Water Hammer.
- Karst, Sink Holes.





Lateral spread

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About Us

Why Choose Us

With vast domain experience, highly capable & equipped Engineering Team we are specialized in providing the most professional Engineering services with fast turn around time. We also help businesses meet their goals with our cutting edge Engineering & Training services.

Mission

Our mission is to deliver world-class engineering solutions with simplicity, precision, and speed, while empowering professionals through comprehensive training that meets global industry standards.

Vision

To create a future where our cutting-edge expertise in engineering solutions and professional training empowers both clients and the industry, making us an indispensable partner in their success.

Our Core Values

1) INNOVATION

We consistently challenge the status quo by exploring new ideas & technologies to deliver creative, cutting-edge solutions.

2) INTEGRITY

We operate with unwavering honesty & transparency, building lasting trust with every client and partner.

3) CUSTOMER FOCUS

We are committed to understanding our clients' unique challenges & providing tailored, value-driven solutions.

4) ETHICS

We collaborate & support one another, believing our collective strength drives the best results for our clients.

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Know The Trainer

Gaurav Bhende

Gaurav has **22+ years of experience** in Oil & Gas, Process, Petrochemical industry. He is specialized in **Piping / Pipelines Stress Analysis** (Static and Dynamic) and Design. He has great experience in Professional Trainings. He has Presented **white papers** in international conferences including ASME conferences. He has Played a key role in establishing Stress engineering group and lead the Stress Group in Worley Parsons, Abu Dhabi and Mott MacDonald, Mumbai. He has worked with renowned organizations like Worley Parsons, Mott Mac Donald, Chemtex Global Engineering and Jacobs Engineering. Gaurav has completed his M. TECH. (Specialization in Machine Design) from VJTI, Mumbai. & Post Graduate Diploma in Piping Engineering. Gaurav is a member of 'American Society of Mechanical Engineers' & 'Institute of Engineers – India.

Gaurav's Achievements-
First Prize winner of "Drivers of Success" competition for years (2011 & 2012) hosted by Intergraph.
Participated HxGN 2013 global conference as a speaker on topic, "Effect of Modeling Supports with CII's Structural Module on Static and Seismic Analysis".

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Who Should Do This Course?

How We Can Help..!

This course is designed for engineers & professionals involved in the **design, analysis, & support of piping systems** across industries such as **oil & gas, petrochemical, power, marine, and process plants.** It is suitable for individuals at various stages of their career seeking practical skills in pipe stress analysis.

1. **Mechanical / Piping Engineers**
   Professionals responsible for the **structural & stress evaluation of piping systems in plant design, expansion, & modifications.** The course equips them to efficiently analyse loads, thermal effects, supports, & compliance with codes.
2. **Stress Engineers**
   Engineers specializing in stress analysis who need to **strengthen their technical competence** with practical CAESAR II modelling, **evaluation, & result interpretation.**
3. **Engineering Graduates & Entry-Level Engineers**
   Recent graduates or early-career engineers seeking **foundational & applied knowledge** of pipe stress **principles & industry workflows** using CAESAR II.
4. **Project Engineers / Project Leads**
   Professionals overseeing **piping design packages** & ensuring deliverables comply with engineering codes & client specifications.
5. **Piping Design Managers / Technical Leads**
   Managers or team leads aiming to **upskill their teams** or **enhance their own understanding** of stress analysis criteria, deliverables, and software capabilities.
6. **Contractors / EPC Engineers**
   Engineers working with EPC (Engineering, Procurement, & Construction) firms who require hands-on expertise to **perform contract deliverables** for stress analysis or to **review vendor/consultant submissions.**

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Who Should Do This Course?

How We Can Help..!

7. QA/QC Personnel

Quality assurance & control professionals involved in **reviewing stress analysis** deliverables, **ensuring compliance with regulatory standards,** & enforcing best practices.

8. Consultants & Independent Analysts

Consultants who **perform third-party reviews, validation, or specialized stress assessments** for clients across multiple sectors.

Who Will Benefit Most

- Professionals seeking career advancement in mechanical/piping/stress engineering.
- Individuals moving into roles with greater responsibility for design validation and compliance.
- Engineers preparing for industry certifications or competency assessments.
- Teams that want a common technical baseline & standardized deliverables.

Prerequisites (Recommended but Not Mandatory)

- Basic understanding of piping design and mechanical engineering fundamentals.
- Familiarity with general engineering concepts like loads, supports, material properties, and basic statics.
- Prior exposure to any engineering software is beneficial but not required.

While CAESAR II provides powerful tools for modelling & analysing piping systems, relying solely on software outputs can be risky. Our course emphasizes a balanced approach, combining manual engineering calculations with software analysis, ensuring accuracy, reliability, & code compliance.

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Who Should Do This Course?

Key Highlights:

Engineering Fundamentals First

a) Understand the theory behind pipe stress, thermal expansion, sustained and occasional loads.

b) Learn how to perform hand calculations for simple scenarios to verify software results.

Validation of Software Outputs

a) Learn techniques to cross-check CAESAR II outputs against manual calculations.

b) Identify potential modeling errors, unrealistic boundary conditions, or overlooked loads.

Develop Practical Engineering Judgment

a) Gain the ability to interpret CAESAR II results critically, rather than accepting them blindly.

b) Understand when software results are plausible & when corrective action is required.

Compliance with Industry Standards

a) Reinforce ASME code compliance by comparing hand calculations with software analysis.

b) Ensure that deliverables meet EPC and client expectations for accuracy, safety, & professionalism.

Enhanced Career Competence

a) Engineers trained in both manual calculations and software validation are highly valued by employers.

b) This dual skillset ensures the engineer can **solve complex problems independently** & confidently justify design decisions.

Our course ensures that you not only master CAESAR II software but also retain the core engineering skills needed to validate and trust your analysis results.

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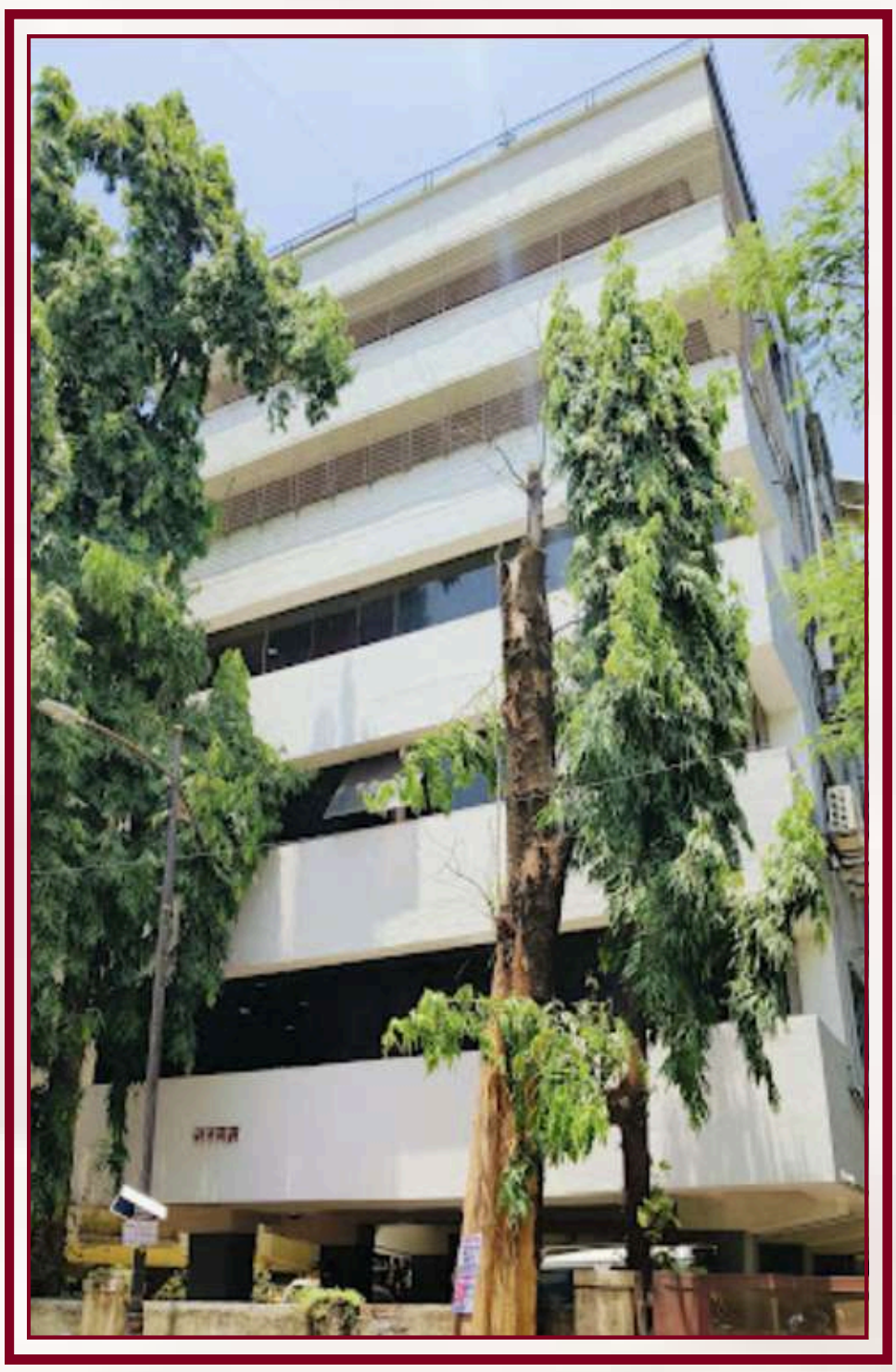
Design Services

About Us

With a vast experience in Static Equipment Engineering, we offer the best, cost efficient solutions to our customers. Our Engineering team is capable to deliver Design of Pressure Vessel, Heat Exchanger, Condenser, Reactor, Column, Storage Tank, and other static equipment, as per various national and international codes and standards.

The team is well experienced and trained to deliver Design as per ASME Sec VIII Div-1, Div-2, PED, ADMerk Blatter, PD5500, AS1210, GOST, TEMA, API 660, API 650, API 620, IBR, EN13445, etc.

We have successfully completed many ASME U-stamp audits and worked on hundreds of U-stamp vessels closely with many certifying agencies.



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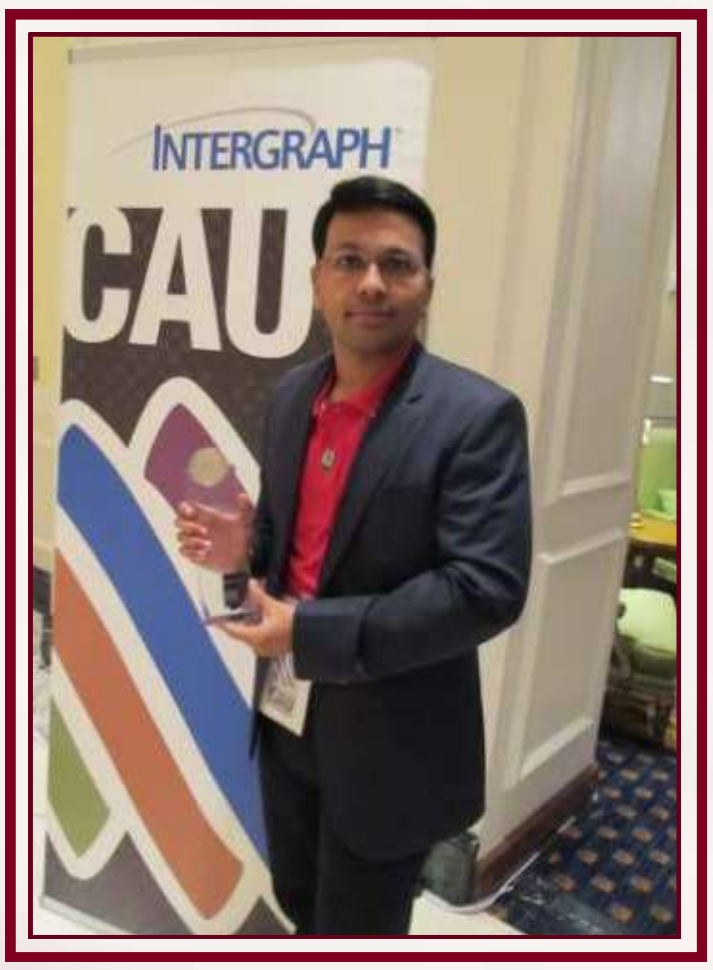
Training Services

About Us

Our training program offers a unique and professional platform for engineers to master their skills to meet the demanding requirements of industries. As an Authorized Training Provider for ASME, we stand firmly behind our mission: “**No one can decode the code like us.**” This expertise is rooted in our deep understanding of various national and international standards, delivered by **seasoned industry veterans** who are currently active in their fields to bridge the gap between theory and real-world application.

Drawing on extensive multi-disciplinary expertise, we provide **comprehensive** courses tailored to the rigorous demands of today’s market. In a remarkably short time, our **commitment to excellence** has established us as the most trusted and preferred training partner for leading corporations and ambitious individuals globally.



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Corporate Training

Onsite Corporate Trainings

We have been instrumental in developing the manpower for organizations through our onsite training under our corporate training program. These training have helped the corporates to develop the skills and knowledge of their resources and as a result increase the output with better and optimized design of equipment.

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Our Customers

Our Corporate Customers

We have been instrumental in developing the workforce for organizations through our onsite training under our corporate training program. These training has helped the corporates to develop the skills & knowledge of their resources & as a result increase the output with better & optimized design of equipment.

LEWA Creating Fluid Solutions
PESCO
شركة الزامل للصناعات المعدنية الثقيلة AL ZAMIL HEAVY INDUSTRIES LTD.
Quality International
SIGMA ENGINEERING WORKS
VeeTech

قافكو QAFCO شركة قطر للاسمدة الكيماوية QATAR FERTILISER COMPANY
KROHNE
FABTECH
JMS Johar Manufacturing Services LLC
فابكون FABCON

DOLPHIN GLOBAL HOLDINGS
TOYO ENGINEERING
L&T
PALL PALL CORPORATION
prestige ENGINEERING
Glatt
KNM

habu Technology FZCO
praj Innovate • Integrate • Deliver
T.EN TECHNIP ENERGIES
PROTECTS Tetra Pak WHAT'S GOOD
sgl carbon
HP
THERMAX

Al Shirawi FM Experience the difference...
TI
MARMON
Crystal industrial
PADMATECH INDUSTRIES PVT LTD
Transheat Technologies

HEXAGON
KOCH FLOW TECHNOLOGY
CELEROS
kirloskar Chillers

pharmadule A Morimatsu Group Company
PRECISION EQUIPMENTS Integrity | Quality | Safety | Sustainability
MBM AUTOMATION & ROBOTICS wide range of Passive Fire Protection solutions
PRECISION GASIFICATION SERVICES PVT. LTD.

protton synergy +vely charged
unitop aquacare
ISGEC ISGEC HEAVY ENGINEERING LTD.
CRYOLOR ASIA PACIFIC
wood.

ALKYL
GRAHAM ENGINEERING ANSWERS A GHM COMPANY
desmet ballestra Science behind Technology
FORBES MARSHALL

CPG CHANDERPUR GROUP
Alleima
LONE

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Our Track Record

How We Have Been Doing..!

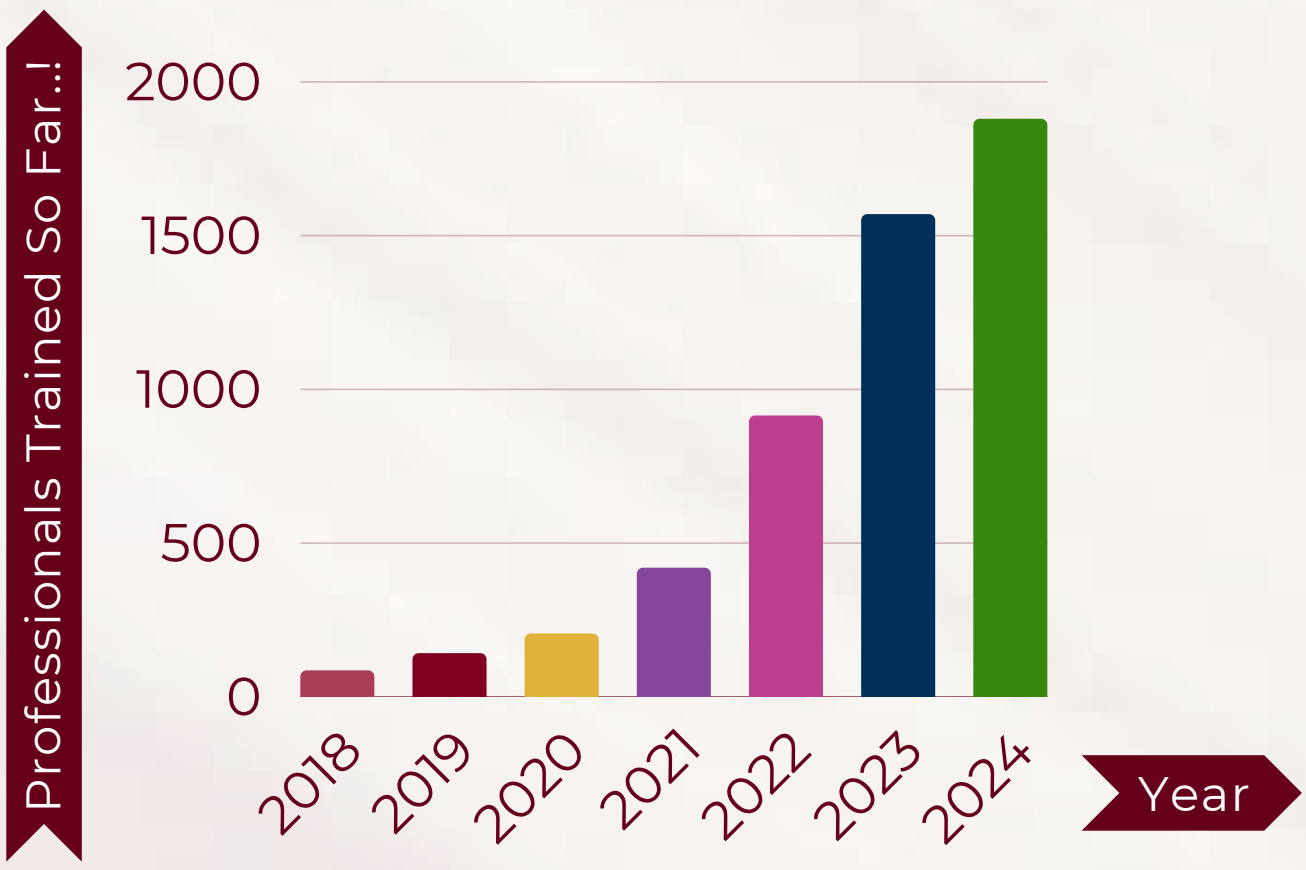
100+ Corporate Customers

4000+ Satisfied Trained Individual Online & Offline Combined

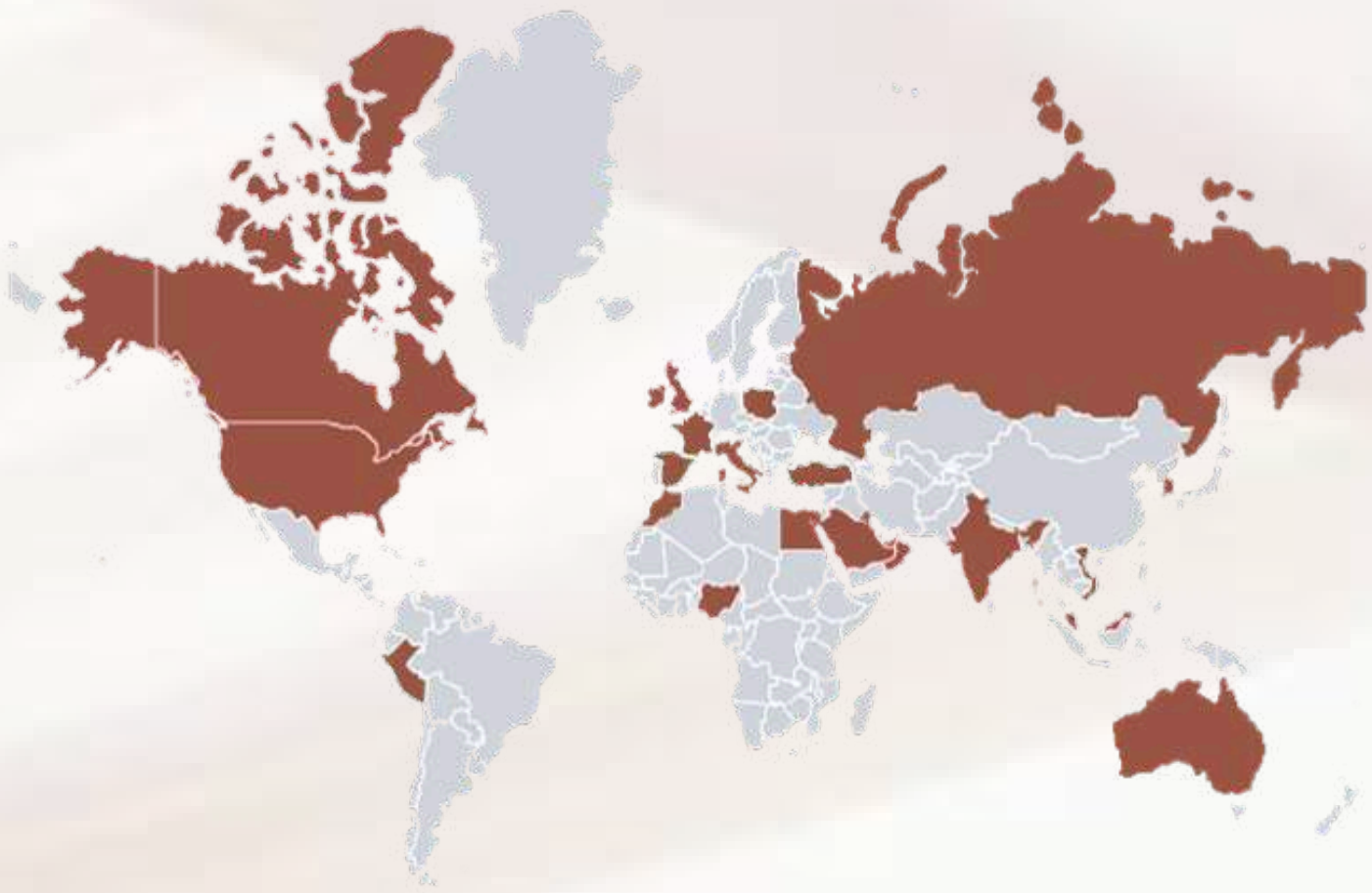
20+ Countries With Beneficiaries Across The Globe

0-28 Experience Range Of Engineers Trained

Over The Year...!



Beneficiaries Across The Globe



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About Training Platform

Mobile & Laptop/ Desktop

Expert and Professional training available at your convenience, with our Mobile & Desktop application.

WATCH FREE LECTURE VIDEOS

GET IT ON Google Play

Download on the App Store

PLAYSTORE

IOS APP

use organization code yatgi

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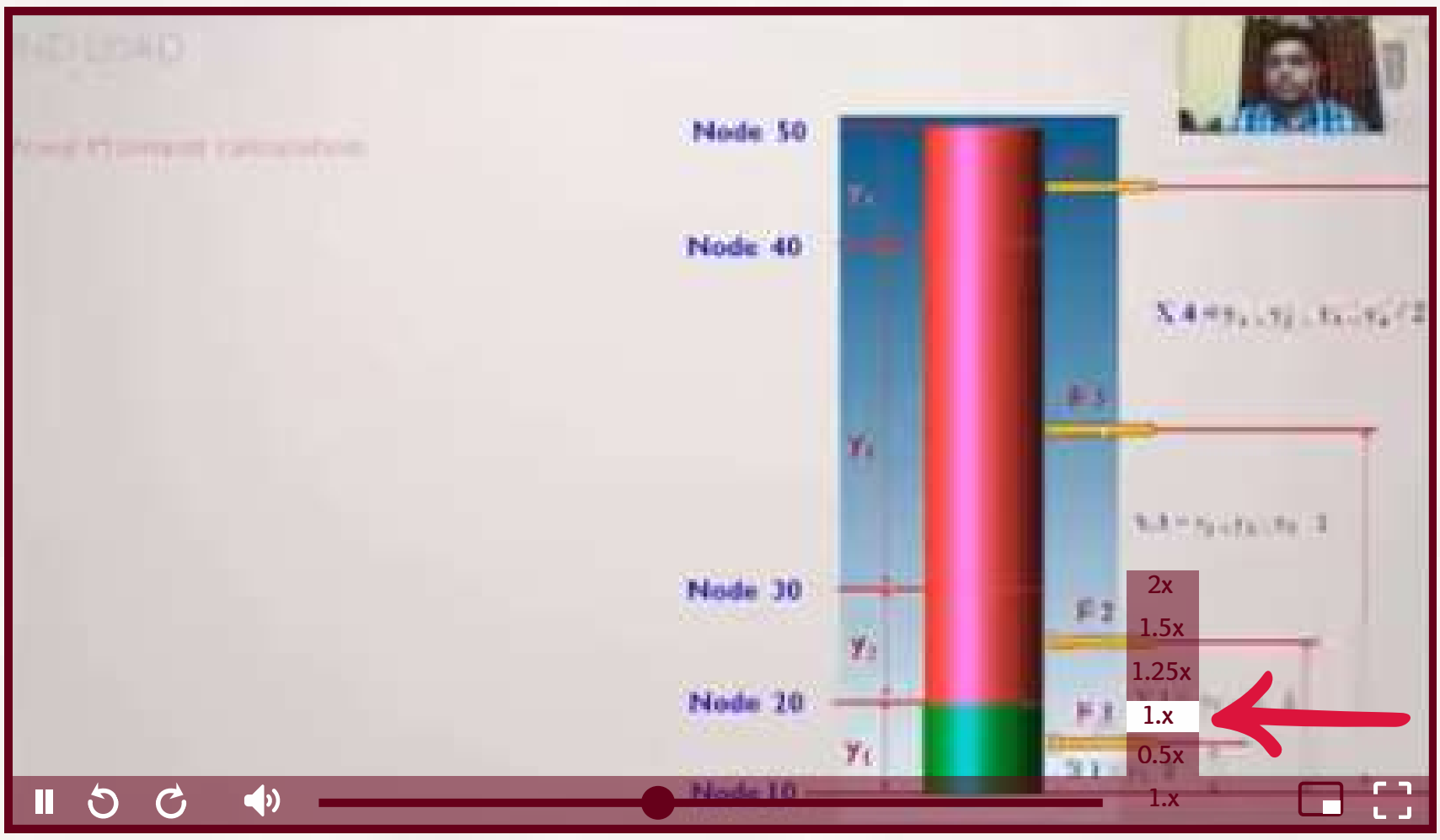
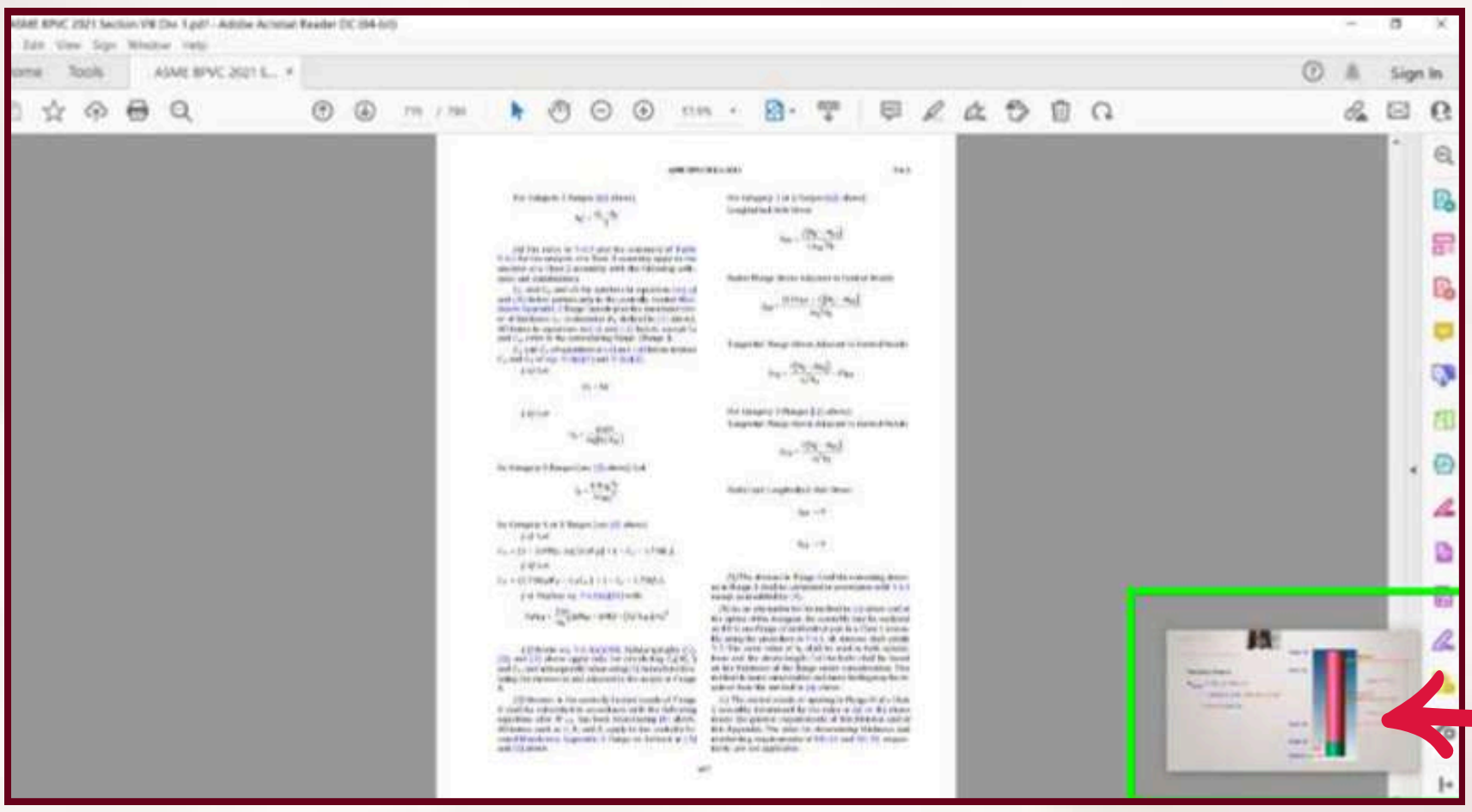
About Training Platform

Special Features

It has never been so convenient to learn...! Check out some special features of our Training Platform. Adjust video speed from 0.5x to 2x to suit your requirement.



PIP mode enables you to work or practice simultaneously while watching the lectures.



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Advantages Over Offline Courses

Benefits Of Online Training

Offline	Online
No more compromise on work or personal schedule	
Getting late for the class. **Need to rush** or I'll miss the lecture.	I can **save travelling time** and **avoid stress** by watching lectures online **as per my convenience.**
Get answers on the go...!	
I am stuck in the Project. But this topic is scheduled after 4 weeks in the live class. **How can I solve it now?**	I was stuck..! But I **just watched this topic online** and bingo..! **the problem is solved.** I simply love this platform.
Live Q&A session every week	
The Classes are over. **Whom can I ask** the questions now?	My Course **validity is 18 months**. Also the **live Q&A** session is **twice a week.** I can get all the answers.

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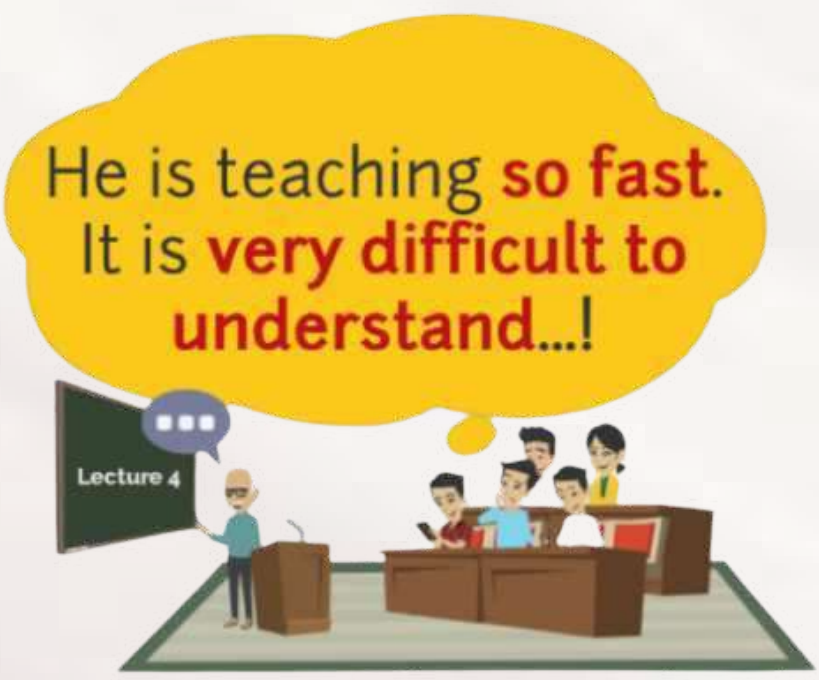
Advantages Over Offline Courses

Benefits Of Online Training

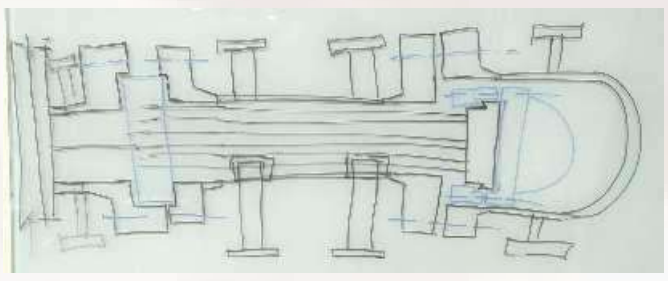
Offline	Online

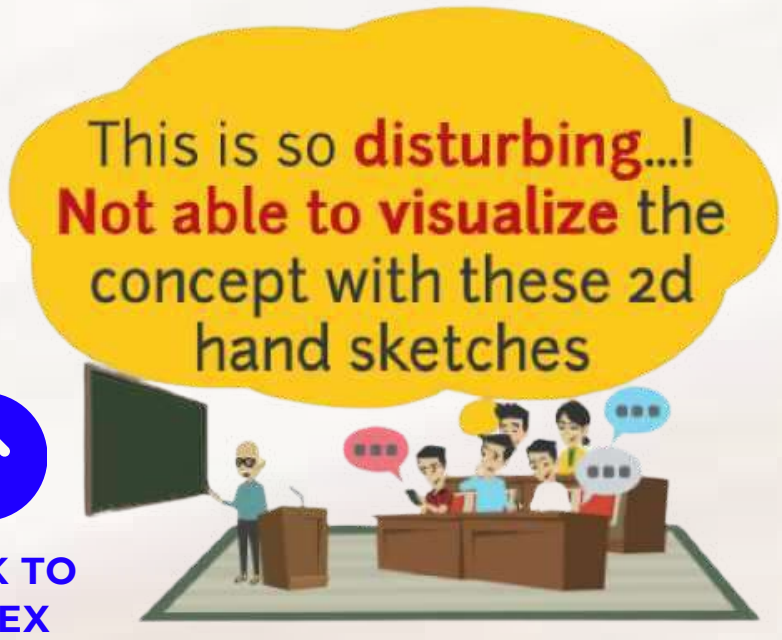
Never Miss Out On Any Lectures

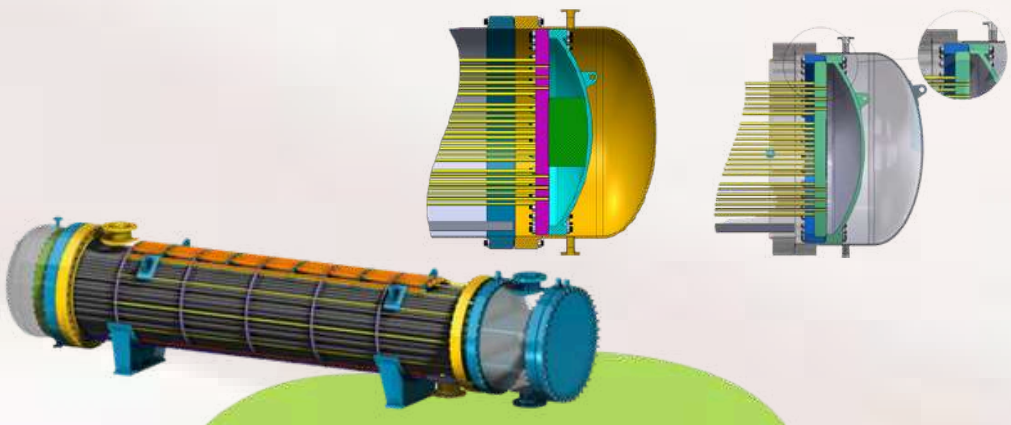
Learn At Your Own Pace



No Disturbances | Video Lectures | Animations







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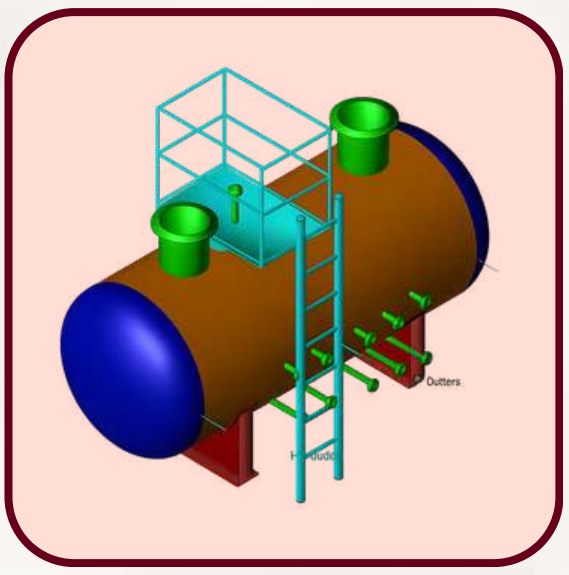
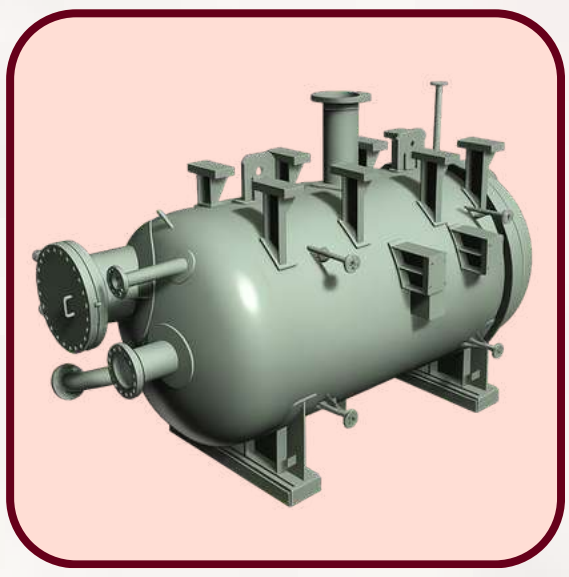
Our Other Courses

Static Equipment Design

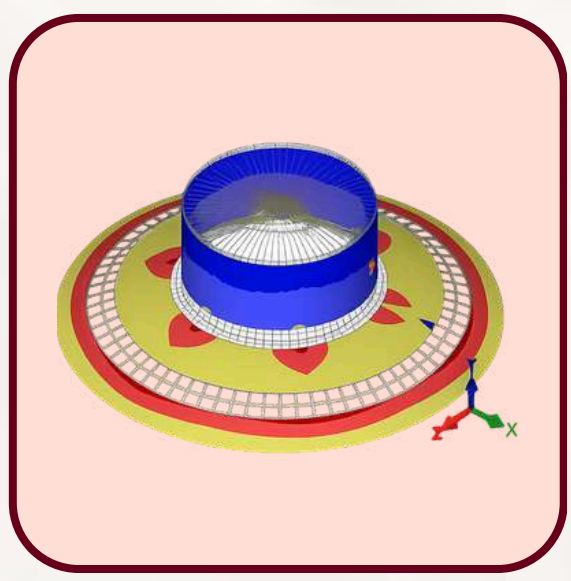


PRESSURE VESSEL DESIGN (DIV 1)

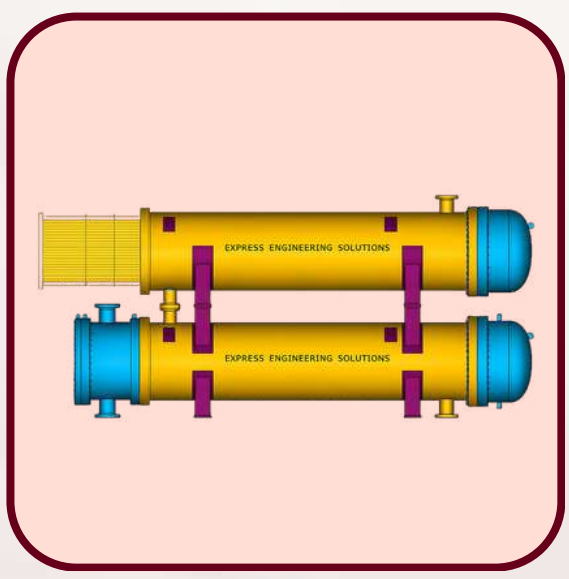
PRESSURE VESSEL DESIGN (DIV 2)



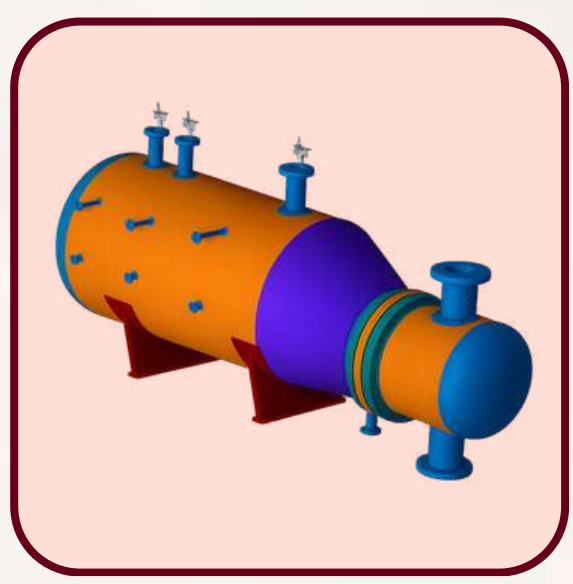
PREMIUM COMBO



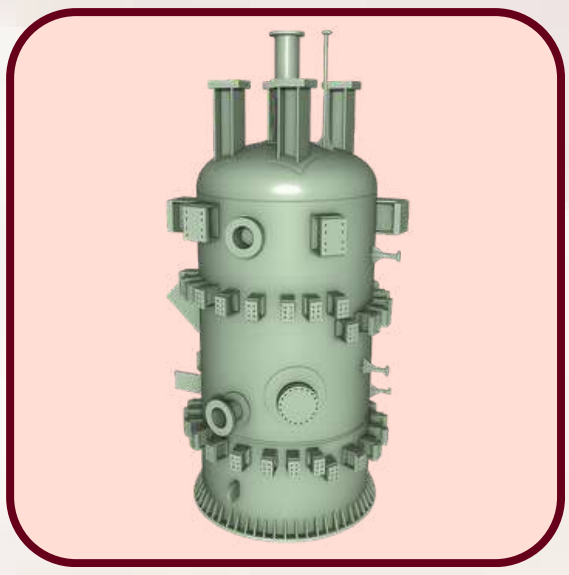
NOZZLE PRO FEA



HEAT EXCHANGER DESIGN



PV ELITE SOFTWARE



DIV 1 & DIV 2 COMBO

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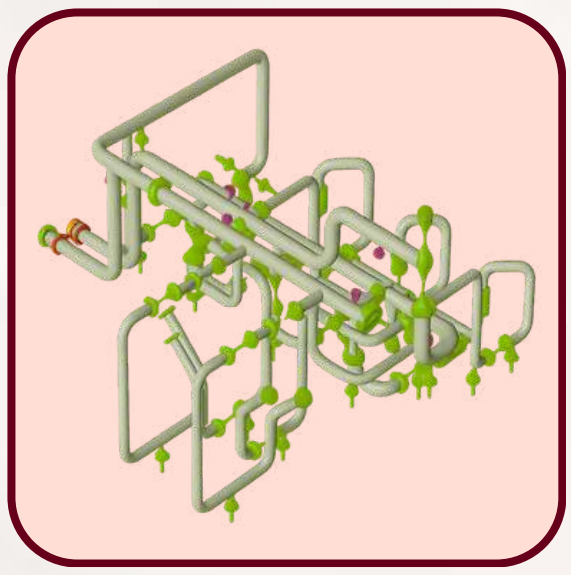
Our Other Courses

ASME AUTHORIZED COURSE

ASME PD442

PIPE STRESS ANALYSIS

BASIC PIPE STRESS ANALYSIS



ADVANCE PIPE STRESS ANALYSIS

BURIED PIPELINE STRESS ANALYSIS

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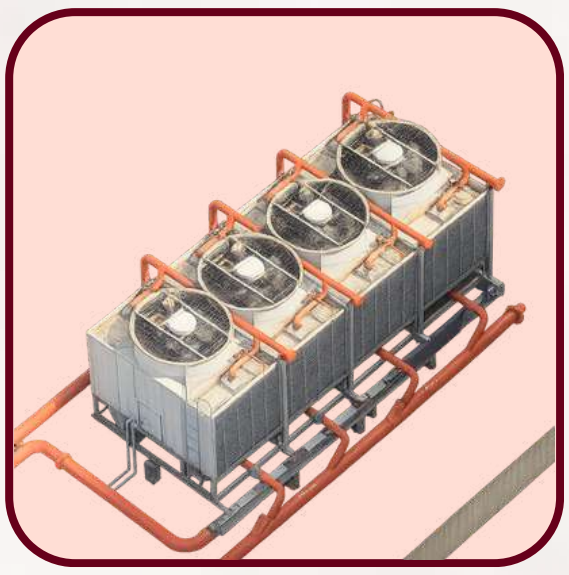
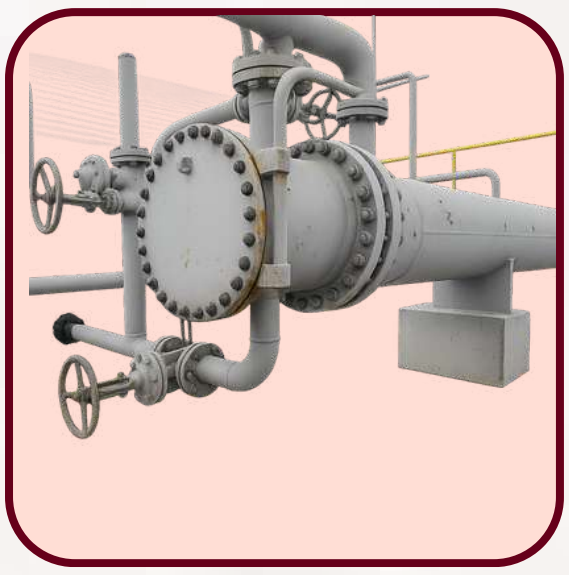
Our Other Courses

Thermal Design



AIR-COOLED HEAT EXCHANGER (ACHE)



SHELL & TUBE HEAT EXCHANGER (STHE)

THERMAL DESIGN COMBO (STHE & ACHE)

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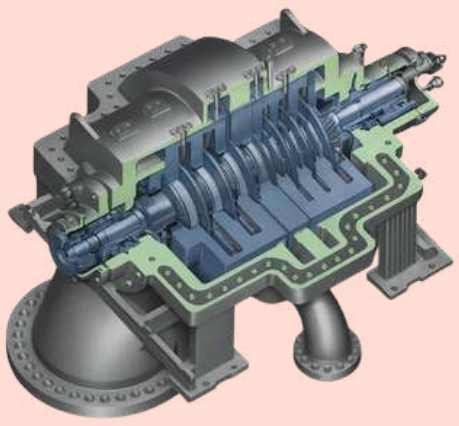
Our Other Courses

ROTARY EQUIPMENT DESIGN



CENTRIFUGAL COMPRESSOR

CENTRIFUGAL PUMPS IN OIL & GAS INDUSTRY

ROTARY EQUIPMENT DESIGN COMBO

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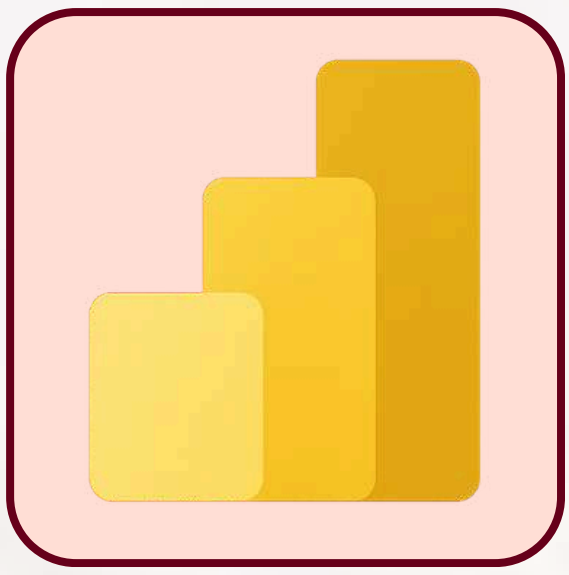
Our Other Courses

OTHER COURSES

MS EXCEL



POWER BI

GD&T (BASIC)

GD&T (ADVANCE)

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SURAT

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Near Gaurav Path Road, Palanpore,
Surat, Gujarat - 395009

SCAN FOR WEBSITE

CLICK FOR WEBSITE