



# ANSYS

**DURATION**  
**45 Days**

## 1. INTRODUCTION TO FEA AND ANSYS

### Introduction to FEA

- General Working of FEA
- Nodes, Elements, and Element Shapes
- General Procedure of Conducting Finite Element Analysis
- FEA through ANSYS
- Effective Utilization of FEA Software
- Advantages and Limitations of FEA Software

### Key Assumptions in FEA

- Assumptions Related to Geometry
- Assumptions Related to Material Properties
- Assumptions Related to Boundary Conditions
- Assumptions Related to Fasteners

### Types of Analysis

- Structural Analysis
- Thermal Analysis Fluid Flow Analysis
- Electromagnetic Field Analysis
- Coupled Field Analysis

### Important Terms and Definitions

- Strength (Resistance to Deformation)
- Load
- Stress
- Strain
- Elastic Limit

- Ultimate Strength
- Factor of Safety
- Lateral Strain and Poisson's Ratio
- Bulk Modulus
- Creep
- Engineering Materials

## **Introduction to ANSYS**

- System Requirements
- Getting Started with ANSYS
- Interactive Mode
- Batch Mode
- Starting a New File Using the ANSYS Product Launcher window

## **ANSYS Output Window**

### **ANSYS Metaphysics Utility Menu Window (ANSYS Session)**

- Utility Menu
- Main Menu
- Graphics Area
- Standard Toolbar
- ANSYS Command Prompt
- Command Window Icon
- Raise Hidden
- Icon
- Reset Picking
- Contact Manager
- ANSYS Toolbar
- Model Control Toolbar
- User Prompt Information
- Current Settings
- Setting the Analysis Preferences
- Units in ANSYS
- Other Important Terms Related to ANSYS
- Dialog Boxes
- Graphics Display

- Standard Toolbar
- ANSYS Command Prompt
- Command Window Icon
- Raise Hidden Icon
- Reset Picking
- Contact Manager
- ANSYS Toolbar
- Model Control Toolbar
- User Prompt Information
- Current Settings

## **Setting the Analysis Preferences**

### **Units in ANSYS**

- Other Important Terms Related to ANSYS
- Dialog Boxes
- Graphics Display
- Panning, Zooming, and Rotating the Model
- Dividing the Graphics Area
- The Pan-Zoom-Rotate Dialog Box
- Graphics Picking
- Using Mouse Buttons for Picking
- ANSYS Database and Files
- Saving the File
- Resuming the File
- Clearing the Database
- Some Basic Steps in General Analysis Procedure
- Points to Remember while Performing an Analysis
- Exiting ANSYS
- Self-Evaluation Test

## **2. BASIC SOLID MODELING**

- Solid Modeling in ANSYS
- Solid Modeling and Direct Generation
- Solid Modeling Methods
- Bottom-up Construction
- Top-down Construction

- Considerations before Creating a Model for Analysis
- Details Required
- Symmetry
- Creating Geometric Entities
- Creating Lines
- Creating Arcs
- Creating B-Splines
- Creating Fillets between Intersecting Lines
- Creating Areas
- Creating and Modifying Work planes
- Display Working Plane
- Show WP Status
- WP Settings
- Offset WP by Increments
- Offset WP to
- Align WP with
- Coordinate Systems in ANSYS
- Global Coordinate System
- Local Coordinate System
- Active Coordinate System
- Display Coordinate System
- Nodal Coordinate System
- Element Coordinate System
- Results Coordinate System
- Creating New Coordinate Systems
- Deleting Existing Coordinate

### **3. ADVANCED SOLID MODELING**

- Advanced Solid Modeling
- Creating Volumes
- Extruding Entities
- Extending the Line
- Creating Complex Solid Models by Performing Boolean Operations Modifying the Solid Model
- Scale
- Move

- Copy
- Reflect
- Deleting Solid Model Entities
- Importing Solid Models
- Importing the IGES File
- Importing Models from Pro/ENGINEER
- Importing the Model from Unigraphics

## 4. FINITE ELEMENT MODELING (FEM) – I

- An Overview of the Finite Element Modeling
- Element Attributes
- Element Types
- Reasons Why ANSYS has a Large Element Library
- Real Constants
- Material Properties
- Multiple Attributes
- Assigning Multiple Attributes before Meshing
- Assigning Default Attributes before Meshing
- Modifying Attributes after Meshing
- Verifying Assigned Attributes
- Element Attributes Table

## 5. FINITE ELEMENT MODELING (FEM) – II

- Finite Element Modeling (FEM) – II
- Mesh Generation
- Mesh Density
- Meshing the Solid Model
- Setting Element Attributes
- Defining the Mesh
- Defining the Entity to be Meshed
- Defining the Meshing Type
- Meshing the Model
- Refining the Mesh Locally
- Extruding the Mesh
- Transitional Pyramid Elements
- Requirements for Creating Pyramid Elements

## Requirements for Creating Pyramid Elements

- Creating Transitional Pyramid Elements (Hex-to-Tet Meshing)
- Converting Degenerate Tetrahedral (20 nodes)
- Elements into Non-degenerate (10 nodes)
- Tetrahedral Elements
- Plotting Pyramid Elements

## Meshing the Beam with Orientation Nodes

- Creating the Beam Mesh with Orientation Nodes
- Creating the Beam Mesh with Two Orientation Nodes

## Improving the Tetrahedral Element Meshes

- Improving Tetrahedral Meshed Volumes by Using Volumes
- Improving Tetrahedral Meshed Volumes by Using Detached Elements

## Some Additional Tips while Meshing the Model

### Applying Loads

- The Nodal Coordinate System
- Loads in Different Disciplines
- Types of Loads in ANSYS
- Load Steps, Sub steps, and Time
- Applying Loads

### Deleting Loads

- Deleting DOF Constraints
- Deleting all Loads and Load Step Options
- Deleting all Loads Applied on Solid Model
- Deleting all Loads Applied on Finite Element Model

## 6. SOLUTION AND POSTPROCESSOR

### Solution

- Defining the New Analysis Type
- Restarting the Analysis
- Setting Solution Controls
- Setting Analysis Options
- Solving the Analysis Problem

### Post processing the Result

- POST1 (General Postprocessor)
- POST26 (Time-history Postprocessor)

- Result Coordinate System (RSYS)
- Displaying the Deformed Shape of the Model
- Displaying the Minimum and Maximum Stresses
- Listing Reaction Forces
- Listing Stress Values at each Node
- Query Picking
- Path Operations
- Load Case Combinations

## 7. STATIC STRUCTURAL ANALYSIS

Effect of self-weight on a cantilever beam

Analysis of a bicycle handle

Analysis of a stud (pin)

Analysis of a master

## 8. ADVANCED STRUCTURAL ANALYSIS (DYNAMIC AND NONLINEAR)

### Advanced Structural Analysis

- Dynamic Analysis

### Performing the Modal Analysis

- Specifying the Analysis Type, Analysis Options, and Applying Loads
- Obtaining the Solution
- Reviewing Results

### Performing the Harmonic Analysis

- Specifying the Analysis Type, Analysis Options, and Applying Loads
- Obtaining the Solution
- Reviewing Results

### Performing the Transient Analysis

- Specifying the Analysis Type, Analysis Options, and Applying Loads
- Obtaining the Solution
- Reviewing Results

### Nonlinear Analysis

- Geometric Nonlinearity
- Material Nonlinearity

- Boundary Nonlinearity (Changing Status)
- Performing the Nonlinear Analysis
- Specifying the Analysis Type, Setting Solution Controls, and
- Applying Loads
- Obtaining the Solution

## 9: ADVANCED STRUCTURAL ANALYSIS

- Steel tubes and springs structure
- Modal analysis of an airplane wing
- Nonlinear analysis (material nonlinearity)

## 10: THERMAL ANALYSIS

### Thermal Analysis

#### Important Terms Used in Thermal Analysis

- Heat Transfer Modes Thermal Gradient
- Thermal Flux
- Bulk Temperature
- Film Coefficient Emissivity
- Stefan–Boltzmann Constant
- Thermal Conductivity
- Specific Heat

#### Types of Thermal Analysis

- Steady-State Thermal Analysis
- Transient Thermal Analysis

#### Performing Steady-State Thermal Analysis

- Setting the Analysis Preference
- Creating or Importing a Solid Model
- Defining Element Attributes Meshing the Solid Model
- Specifying the Analysis Type, Analysis Options, and Applying Loads
- Solving the Analysis Problem
- Post processing Results
- Performing Transient Thermal Analysis
- Specifying the Analysis Type and Setting Solution Controls

## 11: GENERATING THE REPORT OF ANALYSIS

- Starting the ANSYS Report Generator
- Capturing Images for the Report
- Capturing Animations for the Report
- Capturing Data Tables for the Report
- Capturing Lists for the Report
- Compiling the Report
- Changing the Default Settings of the ANSYS Report Generator
- Error Estimation in Solution
- Percentage Error in Energy Norm (SEPC)
- Element Energy Error (SERR)
- Element Stress Deviations (SDSG)
- Maximum and Minimum Stress Bounds (SMXB and SMNB)