Master Study in Composite Program

Part 1 – Structures

It will contain 4 modules:

Module 1: ETABS offers 3D object-based modelling and visualization tools, fast linear and nonlinear analytical power, comprehensive design capabilities and insightful graphic displays,reports, and schematic drawings that allow users to quickly and easily decipher and understand analysis and design results.

Module 2: SAFE is tool used for designing concrete floor and foundation systems. From framing layout all the way through to detail drawing production, SAFE integrates everyaspect of the engineering design process in one easy and intuitive environment.

Module 3: SAP2000 has proven to be the most integrated, productive and practical general purpose structural program on the market today. It is used for creating complex models and 3D object based graphical modelling environment to the wide variety of analysis and design options completely integrated across one powerful user interface.

Module 4: CSI BRIDGE, RCDC, PROKON, STAAD PRO

Modelling, analysis and design of bridge structures can be done in CSI Bridge which helps to create the ultimate in computerized engineering tools. RCDC is the industry leading concrete detailed engineering software. PROKON Structural Analysis and Design is a suite of overforty structural analysis, design and detailing programs. STAAD or (STAAD.Pro) is a structural analysis and design software application originally developed by Research Engineers International in 1997.

The detailed syllabus of above-mentioned module has been included along with this document.

ETABS Basic

Introduction to ETABS

1. Software algorithm.
2. Capabilities of the software.
3. Strengths and weaknesses of the software.
4. ETABS manual.
5. Significance of menu buttons and icons.
6. Sample models and templates.
7. Hands on software on sample templates.

Modelling: process and techniques

1. Geometry creation process
2. Modelling through import method: 2d import, 3d import
3. Other import techniques.
4. Property assignment through automation existing templates.
5. Loadings: dead, live, wind, earthquake, temperature, notional, live load reduction.
6. Details of wind tunnel & its loadings, standardization of wind model & ETABS model.
7. Releases, diaphragms, all definition parameters.
8. Checks on modelling techniques.
9. Modelling of steel & composite structure
10. Hands on software to perform the modelling process and techniques.

Analysis: process and techniques

1. Static analysis
2. Dynamic analysis
3. Second order p-delta analysis
4. Sequential analysis
5. Time history analysis
6. Significance of each analysis and its uses.
7. Checks on lateral stability, deflection, storey drift, torsional irregularity, mass irregularity and stiffness irregularity.
8. Hands on software to perform the analysis and its checks.

Design: methods and techniques

1. Design of columns and beams: methodology & limitations.
2. Design of composite columns.
3. Design of walls & slabs

ETABS Advance

Introduction, modelling process and techniques

1. Introduction to the Various complexities like Geometrical Complexity, Code based Complexities, Structural Engineering fundamental Based complexity.
2. Introduction to the Stiffness Modification Factors for Various elements of the building.
3. Introduction of the complex modelling techniques.
4. Modelling of various type of composite Columns.
5. Modelling with insertion point and its significance.

Analysis: Process and Techniques

1. Different types of Complexities in the project and how to deal with efficiently.
2. Stiffness Modification Factor for the various Building elements and their uses and application along with the codal norms.
3. International norms for Highrise building analysis and design.
4. Gust factor analysis for the application of wind load on the tall building.
5. Wind tunnel analysis and its use in Highrise buildings.
6. Highrise committee norms, its structural significance, its optimization and reporting.
7. Why Non-linear (Buckling, Creep and Shrinkage) analysis is important for Highrise buildings? When to perform, how to perform and what are the parameters to be considered practically.
8. Modal analysis: study and its use in model dynamics time history analysis.
9. Vibration analysis and it use in the steel structure.
10. Energy v/s virtual work diagrams. Its application and use.
11. Modelling of composite structure, analysis and design techniques.
12. Torsional Irregularity and Orthogonal axis analysis and its application.
13. Soft storey checks and its application using various codes.

Design of structural elements

1. Design of columns, beams, slabs, shear walls, transfer slabs and brace elements.
2. Structural design optimization after all advance analysis.

SAFE

Introduction Theory

1. Software Algorithm
2. Capabilities of the software.
3. Strengths and weaknesses of the software.
4. SAFE manual
5. Significance of menu buttons and icons.
6. Sample models and templates.
7. Hands on experience on sample templates.

Modelling: Process and Techniques

1. Geometry creation process
2. Modelling through import methods
3. Combined, complex foundation system
4. Modelling of foundations, basements, footings and flat slabs.
5. Property assignment of rigid zones for walls and ramps.
6. Usage of insertion point for beams and columns.
7. Property assignment for spring supports.
8. Uses of design strips.
9. Definition of post-tensioning in slabs.
10. Tendon load and its losses.
11. Loading: dead, live, wind, earthquake, temperature, notional, live load reduction.
12. releases, supports, diaphragms, all definition parameters.
13. Checks on modelling techniques.

Analysis: Process and techniques

1. Interaction between ETABS and SAFE.
2. Soil structure and interaction.
3. Checks on foundation system
    a. Deflection.
        i. Short term deflection.
        ii. Long term deflection considering creep.
    b. Crack Width
    c. Punching Shear
        i. One-Way Shear.

ii. Two-Way Shear.
d. Reinforcement checks.
4. Differential settlement of foundation and its control.
5. Nonlinear analysis by considering long term creep.
6. Nonlinear analysis for cracked conditions.
7. Analysis of flat slab.
8. Checks on foundation system and flat slabs against lateral forces (static/dynamic).
9. Significance of each analysis and its uses using various codes.

Design: Methods and techniques

1. Design of stirrups.
2. Design of slabs based on finite element method.
3. Design of raft & pile foundations.
4. Design methodology.
5. Design of punching shear reinforcement (stud rails).
6. Flat slabs with post tensioning.
7. Checks on post tensioning stress.
8. Generating output & display of deformed geometry.
9. Detailing & reporting techniques.
10. Codes & software interaction by considering national and International Codes.

SAP2000

Introduction Theory

1. Software algorithm.
2. Capabilities of the software.
3. Strengths and weaknesses of the software.
4. SAP2000 manual.
5. Significance of menu buttons and icons

Modelling: Process and techniques

1. Creation of geometry for beams.
2. Creation of sloped, vertical & Pratt truss.
3. Combined, complex modelling of roof truss, transmission tower & guyed tower.
4. Modelling of portal, braced (concentric & eccentric) frames.
5. Modelling of open frame building, perimeter frame building and beam slab building frames.
6. Modelling of flat slabs and walls.
7. Complex modelling of cylinder, barrel shell, multi bay cylindrical shell, hyperbolic, paraboloid, partial sphere, spherical dome, parabolic dome.
8. Creation of dog legged & spiral staircases.
9. Modelling of overhead tank, underground tank & storage silos.
10. Creation of geometry for complex thick arch, variable arch,   prism & block models.
11. Loading: dead, super dead, live, wind, earthquake & live load   reduction.
12. Releases, supports, diaphragms, all definition parameters.
13. Checks on modelling techniques.
14. Oceanic Engineering for offshore structures analysis and design.

Analysis: Process and techniques

1. Interaction between AutoCAD and sap2000.
2. Discussion on the Thermal conductivity matrix analysis and its requirement on various structure like Chimney, etc.
3. Checks on underground structures.
    a. Deflection
        i. Short term Deflection.
        ii. Pressure bulb for t/c reinforcement.

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      b. Crack width.

      c. Reinforcement checks.

4. Linear & Non-linear, Static and Dynamic analysis (Time History, Pushover, Performance Based Design, etc.)
5. Nonlinear Staged, static construction analysis.
6. Significance of each analysis and its uses using various codes.

Design: Methods and Techniques

1. Design of steel structures
2. Design of concrete structures.
3. Output & display of deformed geometry.
4. Detailing & reporting techniques.
5. Codes & software interaction by considering national & international codes.

CSI BRIDGE

Introduction to the software

1. Software algorithm.
2. Capabilities of the software.
3. Strengths and weaknesses of the software.
4. CSI bridge manual.
5. Significance of menu buttons and icons.
6. Sample models and templates.
7. Hands on software on sample templates

Modelling: process and techniques

1. Create a concrete box girder bridge
2. Bridge wizard
3. Layout line
4. Deck section
5. Bridge object
6. Parametric variation
7. Bridge object assignment
8. Load the bridge model

Analysis: process and techniques

1. Bridge responses
2. Run analysis
3. Display results
   A. Graphical Displays
   B. Output Tables

RCDC

Introduction to the software

1. Software algorithm.
2. Capabilities of the software.
3. Strengths and weaknesses of the software.
4. Import and Export from/to the Various design software.
5. Significance of menu buttons and icons.
6. Sample models and templates.
7. Hands on software on sample templates

Modelling: process and techniques

1. Sample Slab Detailing
2. Sample Beam Detailing
3. Sample Column Detailing
4. Sample Shear wall Detailing
5. Sample Footing Detailing
6. Exporting of various files to AutoCAD.
7. Template Good for construction drawing showcase.

Analysis: process and techniques

1. Importing of template design
2. Setting of various detailing parameters
3. Detailing of various elements.
4. Exporting of various detailing into the AutoCAD
5. Hands on software to perform the design process and techniques
   - Graphical displays
   - Output tables

Prokon

Introduction: Theory

1. Software algorithm.
2. Capabilities of the software.
3. Strengths and weaknesses of the software.
4. Prokon manual
5. Significance of menu buttons and icons.
6. Sample models and templates.
7. Hands on experience on sample templates

Analysis and designing: process and techniques - for individual elements

1. Geometry creation process
2. Designing of reinforced concrete structural elements
3. Designing of complex structural elements
4. Property assignments
5. Loading: dead, live, wind, earthquake, temperature, notional, live load reduction
6. Designing of steel trusses
7. Steel connection design - base plates, gusset plate
8. Designing of timber structural elements
9. Hands on software to perform the design process and techniques

Part 2 – BIM & Project Management

A. SOFTWARE PACKAGE
1. AUTOCAD
2. REVIT (Architecture, Structure &MEP)
3. NAVISWORKS
4. MICROSOFT PROJECT
5. SPREADSHEETS
6. TEKLA STRUCTURES
7. SYNCHRO PRO
8. PRIMAVERA
9. ECONSTRUCT IN-HOUSE SOFTWARE

B. BIM INTERNATIONAL CODES AND STANDARDS
1. BS1192:2007.
2. PAS1192-2:2013.
3. PAS1192-3:2014.
4. BS1192-4:2015.
5. COBie Data Formulation.

C. TYPE OF GIVEN PROJECT
1. Residential Villas.
2. Residential (Midrise, Highrise).
3. Commercial (Midrise, Highrise).
4. Steel Structures.
5. Industrial Composite.
6. Infrastructure; Road Development projects.

D. INTRODUCTION TO BIM TECHNOLOGY
1. What is BIM and how does BIM technology works?
2. What is BIM Life-Cycle?
3. Why should one opt for BIM?
4. When should one opt for BIM?
5. BIM for Architects, Civil Engineers, MEP engineer and Project Managers.

6. How to get the effective output from BIM model.
7. Hands on software on sample templates.
8. What are the Advantages and Disadvantages of BIM?

E. INTRODUCTION TO 2D PLANNING

1. What is Architectural planning?
2. What is structural planning? What are their attributes?
3. What is 2D MEP plans and how to formulate them?
4. What are GFC Dawings and how to create them?
5. How to draw 2D Elevation and Sectional view?
6. What is Air and Light Ventilation in 2D planning?
7. How is Planning related to Vastu?
8. What is Vastu & how does Vastu technology works?
9. What is the Significance of Vastu?

F. AUTOCAD: 2D INTERFACE

1. INTRODUCTION TO AutoCAD

- AutoCAD Screen Components
- Invoking Commands in AutoCAD
- AutoCAD Dialog Boxes
- Setting of Drawing Units and Dimension style units.
- Drawing Lines in AutoCAD
- Prompt Coordinate Systems
- Object Selection Methods
- Setting Units Type and Precision
- SETTING the Limits OF A DRAWING

2. DRAWING COMMANDS

- What are the various Drawing Commands used by the working professionals?
- What is Engineering CAD?
- How, when and where to use which command to have the best output and minimumpossible time.
- What are the most suitable commands for 2D Architectural

planning, Structuralplanning and MEP planning?
- Learn how to draw Lines, Circles; two points, three points and tangent-tangent- Radius circle, Arcs and its types, Rectangles, Ellipses, Polygon, Polylines, MultilineInfinite Lines etc. effectively.
- Writing a Single Line Text
- How to use Hatching command and its respective purpose.

3. **MODIFYING COMMANDS**
- What are the various modifying commands; such as - Copy, Move, Stretch, Trim, Extend, Erase, Rotate, Fillet/Chamfer command, Array; Path, Polar & Rectangularcommand, Offset, Mirror, Block, Scale, Explode etc. Also, how and where to use these commands to prepare the best Plans, GFC, Shop Drawings?
- VPORT command and its significance?
- Layout and its use.

4. **WORKING WITH DRAWING AIDS**
- Understanding the Concept and use of LAYERS
- Working with Layers
- Object Properties
- What are Xref and 3Dface command and is it useful to industries?

5. **CREATING TEXT AND TABLES**
- Annotative Objects.
- Annotation Scale.
- Multiple Annotation Scales.
- Controlling the Display of Annotative objects.
- Creating Text.
- Entering Special Characters.
- Creating Multiline Text.
- Editing Text.
- Inserting Table in the Drawing.
- Creating a New Table Style.

6. **Model Space Viewports, Paper Space Viewports & Layouts.**
7. **Plotting Drawings.**
8. **Hatching Drawings.**
9. **Working with Blocks.**
10. **AutoCAD 3D BASICS INTERFACE:**
    - 3D basic commands.
    - Isometric concept and Drawings.
    - Isometric commands.
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G. 3D-REVIT
1. **INDUSTRIES: REVIT BENEFIAL FOR:**
    - ARCHITECTURAL MODELLING
    - STRUCTURAL ENGINEERING
    - MEP ENGINEERING

2. **FEATURES WITH SPECIFICATION:**

   a) **ARCHITECTURAL DESIGN:**
    - Conceptual design tools.
    - Architectural modelling.
    - 3D design visualization.
    - Multi-storey stairs.
    - Cloud rendering & Walkthrough.
    - Massing & siting.
    - Design phases and design options.
    - Family creation.
    - In-place component modelling.

   b) **STRUCTURAL ENGINEERING AND FABRICATION:**
    - Physical and analytical model.
    - Reinforcement detailing.
    - Structural steel modelling.
    - Structural documentation.
    - Bidirectional linking with analysis.
    - Linking with structural fabrication.

c) MEP ENGINEERING AND FABRICATION:
- HVAC design and documentation.
- Electrical design and documentation
- Plumbing design and documentation.
- Fire Protection
- MEP fabrication detailing.
- Fabrication service conversion.
- Fabrication documentation.
- Work-sets & Central file Creation.
- Concept of central file.
- Heating and cooling loads in HVAC system.

H. INTEROPERABILITY AMONG SOFTWARE:
1. Introduction of Different file formats.
2. Standard file formats for exchange
3. Interoperability among software such as;
   - AutoCAD ← to→Revit.
   - Revit ← to→Navisworks.
   - Microsoft Excel ← to→Navisworks.
   - Navisworks ← to→Microsoft Project.
   - Microsoft Project ← to→Microsoft Excel.
   - AutoCAD ← to→ETABS.
   - ETABS ← to→Revit.

I. NAVISWORKS:
1. GETTING STARTED
- Getting Started with Autodesk Navisworks.
- Publishing, Merging/Append, Refreshing, and Emailing Files.
- Selection Tree and Selecting Objects.

2. 3D MODEL REVIEW:
- Hiding Objects and Overriding Materials.
- Object Properties.
- Measuring and Moving Objects.
- Selection and Search Sets.

- Viewpoints.
- Comments, Redlining, and Tabs.
- Animations.
- Sectioning.
- Links.
- Comparing Models.
- Navisworks Real-Time Rendering.
- Switchback.

3. **CLASH DETECTIVE:**
   - Clash Detective Overview.
   - Clash Results.
   - Clash Test Reporting.
   - Working with Clash Tests.
   - Audit Checks.
   - Exporting and Importing Clash Tests.
   - Method for Testing and Resolving Clashes.

4. **4D TIME MODEL; TIMELINER:**
   - Time Liner Overview.
   - Creating Tasks.
   - Gantt View.
   - Import Tasks from External Project File.
   - Configuring and Defining a Simulation.
   - Simulation Export.

5. **QUANTIFICATION:**
   - Quantification Overview.
   - Setting up a Quantification Project.
   - Item and Resource Management.
   - 3D Model and Virtual take-off.
   - Managing take-off Data.
   - 2D Take-offs.
   - Analysing Changes.
   - Exporting Take-off Data.

6. **AUTODESK RENDERING:**
   - Autodesk Rendering Overview.
   - Adding Materials to a Model.
   - Creating and Editing Materials.
   - Material Mapping.
   - Lighting.
   - Sun and Sky Lights.
   - Exposure Control.
   - Ground Planes.
   - Photorealistic Rendering.

J. 5D: COST ESTIMATION:
1. Manual Estimation: Corresponding to Material take-offs.
2. With the help of quantification of Navisworks and Revit software.
3. Value Engineering.
4. 4D-5D Simulation: Real time conceptual modelling and cost planning.

K. 6D: ENERGY MODEL:
1. Lighting analysis.
2. Solar analysis.
3. Heating & cooling analysis.
4. Energy analysis.
5. Revit Insight Integration.

L. 7D: FACILITY MANAGAEMENT:
1. Create life-cycle BIM Strategies.
2. Documentation and manage the life-cycle.
3. BIM Embedded Q&M Manuals; CPIX Assessments.
4. BIM Maintenance Plans and Technical Support.
5. COBie_UK_2012 Compliances and Excel Sheet.

M. PROJECT MANAGEMENT SOFTWARE-BAR CHART, ESTIMATION & COSTING USING DIFFERENT TECHNOLOGIES.

1. MICROSOFT PROJECT
- Work Breakdown Structure (WBS) and its rules.
- Scheduling a project plan.
- Configuring project management software.
- Managing project resources.
- Establishing project baselines for performance.
- Planning & controlling the project.
- Use of BIM & excel in estimation & costing.
- Rate analysis, DSR its application for tendering.
- Estimation thumb rules & through BBS.
- Estimated and projected costing.
- Investment vs. Rate of return Ratio (IRR).
- Profitability vs. Investment Charts.
- Critical Path Methods and Project Evaluation & Review Technique.
- Comparison between CPM and PERT.