

**SAFE**

**1. Introduction Theory**

- a. Software Algorithm
- b. Capabilities of the software.
- c. Strengths and weaknesses of the software.
- d. SAFE manual
- e. Significance of menu buttons and icons.
- f. Sample models and templates.
- g. Hands on experience on sample templates.

**2. Modelling: Process and Techniques**

- a. Geometry creation process
- b. Modelling through import methods
- c. Combined, complex foundation system
- d. Modelling of foundations, basements, footings and flat slabs.
- e. Property assignment of rigid zones for walls and ramps.
- f. Usage of insertion point for beams and columns.
- g. Property assignment for spring supports.
- h. Uses of design strips.
- i. Definition of post-tensioning in slabs.
- j. Tendon load and its losses.
- k. Loading: dead, live, wind, earthquake, temperature, notional, live load reduction.
- l. releases, supports, diaphragms, all definition parameters.
- m. Checks on modelling techniques.

**3. Analysis: Process and techniques**

- a. Interaction between ETABS and SAFE.
- b. Soil structure and interaction.
- c. 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.
- d. Differential settlement of foundation and its control.
- e. Nonlinear analysis by considering long term creep.
- f. Nonlinear analysis for cracked conditions.
- g. Analysis of flat slab.
- h. Checks on foundation system and flat slabs against lateral forces (static/dynamic).
- i. Significance of each analysis and its uses using various codes.

#### **4. Design: Methods and techniques**

- a. Design of stirrups.
- b. Design of slabs based on finite element method.
- c. Design of raft & pile foundations.
- d. Design methodology.
- e. Design of punching shear reinforcement (stud rails).
- f. Flat slabs with post tensioning.
- g. Checks on post tensioning stress.
- h. Generating output & display of deformed geometry.
- i. Detailing & reporting techniques.
- j. Codes & software interaction by considering national and International Codes.