Geotechnical Analysis and Foundations with CivilFEM for ANSYS

1. Program overview

Title: Geotechnical Analysis and Foundations with CivilFEM for ANSYS – online course.

Director: Professor Juan José Benito Muñoz.

Department: Construction & Manufacturing Engineering (UNED University).

2. Eligibility and requirements

A degree is required, although university students in the last year of their course may be admitted with proof of their academic status. Some prior experience with the software is recommended or else previous enrollment in the CivilFEM for ANSYS Introductory Course available in ICAEEC.

3. Goals

The Geotechnical and Foundations course provides 2D and 3D soil mechanics solutions using any combination of beam, shell and solid elements. The interface solves complex structural and soil-structure interaction problems; the analysis accounts for non-linear materials, geometry and contact conditions, as well as the design checking of structural elements.

Applications include tunnels, dams, piles and micro piles, foundation slabs, geotextiles/geogrids, reinforced soils and retaining structures.

This course originated as a collaboration project between UNED and Ingeciber, S.A., a company specializing in Computer-Aided Engineering (CAE).

4. Contents

The Geotechnical and Foundations course was created to provide a powerful tool to assist civil engineers with any type of geotechnical problem.

Within this utility, CivilFEM incorporates a geotechnical database with a wide range of tools used for analyses and calculations. The database contains the following characteristics:

- Includes soil and rock properties.
- Allows the user to make correlations between variables with different origins or

different definitions, a very common practice in Geotechnical work (for example, the correlation between the modulus of elasticity E and the standard penetration test SPT).

- Includes libraries of characteristic properties of soils and rocks as well as a vast number of correlations obtained from related literature and experience.
- Permits users to create customized libraries.

In addition to the resources listed above, the following tools have been included:

- Slope stability analysis, including water table definition, reinforced earth, etc.
- Hoek and Brown model in order to simulate the behavior of rock foundations, and Mohr-Coulomb and Cam-Clay for soils.
- Determination of the ballast module for any type of foundation.
- Generation and calculations of retaining walls.
- Seepage analysis. This tool automatically obtains the saturation line and solves the seepage problem through a porous media.
- Tunnel models.
- Initial stresses for soils.
- Calculation and application of earth pressures on structures.

The content of each subject is detailed below:

- **GEOTECHNICAL ANALYSIS AND FOUNDATIONS**

1. Material library
2. Layered terrains
3. Elastic foundation stiffness
4. Retaining walls and diaphragms
5. Seepage analysis
6. Slope stability
7. Earth pressures
8. Initial stress
9. Pile caps
10. Tunnels

- **Practical Application Exercises with CivilFEM for ANSYS**

The exercises represent a review of the concepts introduced in the subjects taken until now, as well as the orderly use of the CivilFEM for ANSYS.

These exercises will be delivered to the tutor in order to get feedback and recommendations:

1. Elastic foundation stiffness calculation
2. Slope stability analysis
3. Confined flow example in a dam
4. Seepage analysis in a gravity dam
5. Diaphragm walls
6. Pile cap analysis
7. Earth pressures on retaining walls
8. Tunnel excavation process 3D
9. Tunnel excavation process 2D
10. Mohr-Coulomb plasticity model.

5. Schedule

35 hours of study. The course lasts from 1 to 6 weeks with full flexibility since no specific delivery date is indicated.

6. Methodology

Distance learning methodology, including pre-prepared study materials and bibliography, tutorials, audiovisual resources and practical application exercises.

7. Teaching Materials

Attendees will receive the teaching guide and the corresponding materials for each module, which will basically consist of the subject texts.

Furthermore, in order to complete the practical exercises and training, the educational version of CivilFEM for ANSYS will be provided by the course.

The course uses a virtual classroom as a training facility where study tools can be found, and also as the main communication channel with the attendees.

Other tools will also be used including audiovisual resources as well as other complementary documentation.

8. Attendee services

The teaching staff will respond to attendee inquiries via telephone, email, or in person. Phone tutorships will be available within the following hours:

Monday to Friday during office hours and always subject to tutor's availability.

9. Evaluation and grading criteria

Attendee evaluation will be performed through the Practical Application Exercises.

10. Certification

Certification will consist of a diploma from ICAEEC & Ingeciber indicating successful completion of the subject by the attendee as well as the grade obtained in the practical application exercises.

11. Teaching staff

Professor Juan José Benito Muñoz (director). Construction & Manufacturing Engineering Department (UNED).

Mr. Ronald Siat (tutor & coordinator). Ingeciber S.A.

Mr. Román Martín (tutor). Ingeciber, S.A.

12. Fees

Tuition fees are 450,00 €

Current and former attendees of the UNED *Master's in Theoretical and Practical Application of the Finite Element Method and CAE Simulation* will be eligible for a 33% discount.