



Advanced Course in Slope, Seepage and Foundation Analysis

Presented by the Department of Civil Engineering, University of Pretoria

14 - 15 February 2022

2 ECSA CPD Points

The **Advanced Slope, Seepage and Foundation Analysis** short course focuses on a range of analytical techniques incorporated in modern commercial software packages used for geotechnical stability analysis of slopes and walls, as well as seepage and consolidation analysis. The emphasis is on methods other than the finite element method (covered in detail in the Theoretical Soil Mechanics course) including an overview of elasticity, upper and lower bound plasticity methods, limit equilibrium methods with a strong focus on slope stability, as well as finite difference solutions for seepage and consolidation analysis.

The course comprises part of the taught component of a postgraduate subject, Analytical Soil Mechanics SGS 787, taught as part of the Honours Degree course in Geotechnical Engineering at the University of Pretoria. Postgraduate students registered for the Honours Degree in Geotechnical Engineering are required to attend this course and in addition, successfully complete a series of assignments and pass the examination for Analytical Soil Mechanics SGS 787. There is no formal evaluation of other course attendees.

Course content

- Introduction to elasticity and plasticity in Geotechnical Engineering
- Upper and lower bound plasticity methods in Geotechnical Engineering
- Limit equilibrium methods in Geotechnical Engineering with a focus on slope stability analysis
- Finite difference seepage and consolidation analysis

NEXT PAGE 

Shifting knowledge to insight



Advanced Course in Slope, Seepage and Foundation Analysis

Presented by the Department of Civil Engineering, University of Pretoria

Learning outcomes

After successfully completing this course, you should:

Have a basic understanding of the principles of elasticity which includes knowledge of

- Hook's law
- elastic material parameters
- elasticity in one, two and three dimensions
- isotropy and anisotropy
- plane-strain, radial symmetry and 3D conditions

Have a basic understanding of the principles of plasticity which includes knowledge of

- yield criteria (Mohr-Coulomb, von Mises, Tresca, Drucker Prager)
- associated and non-associated flow rules
- hardening laws (perfectly plastic, strain hardening and strain softening materials)

Have a basic understanding of the principles of plastic limit analysis, i.e.

- the theorems of plastic collapse
- upper bound analysis using plastic mechanisms and virtual work principles
- lower bound analysis using stress discontinuities and stress rotation using Mohr circles
- requirements for an exact solution
- introduction to slip line theory

Have a basic understanding of the principles of limit equilibrium analysis

- understand the principle of limit equilibrium
- be able to solve boundary value problems using limit equilibrium analysis
- know the range of limit equilibrium methods for slope stability analysis incorporated into many software packages and their respective assumptions and shortcomings
- understand the principles of enhanced limit equilibrium analysis using numerical analysis.
- understand the principles of the strength reduction technique for geotechnical stability analysis using numerical analysis.

Have an understanding, and the ability to implement in a spreadsheet, finite difference techniques for the solution of

- consolidation problems
- seepage problems

Who should enrol?

This course is ideal for you if you are

- a postgraduate student studying towards your Honours Degree in Geotechnical Engineering at the University of Pretoria
- a civil engineering or engineering geology graduate who has completed undergraduate courses in soil mechanics
- a senior engineer interested in improving your knowledge of geotechnical analytical methods, or
- an engineer who wishes to expand your background in the analytical techniques covered in the course.

Course fees

R6 000.00 per delegate (VAT incl.) for in-person attendance. Course fees include all course material, refreshments and meals.

R3 000.00 per delegate (VAT incl.) for online attendance.

R1 500.00 per delegate for online attendance by attendees from Lower-Middle income and Low-Income economies only. (<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519>)

Course fees must be paid in full 14 days prior to course start dates. Proof of payment can be submitted to enrolments@enterprises.up.ac.za.

Admission requirements

Prospective delegates should ideally hold a degree in civil engineering or engineering geology, with undergraduate knowledge of soil mechanics.

Accreditation and certification

Enterprises University of Pretoria (Pty) Ltd is wholly owned by the University of Pretoria. As a public higher education institution, the University of Pretoria functions in accordance to the Higher Education Act 101 of 1997. Enterprises University of Pretoria offers short courses on behalf of the University and these short courses are not credit-bearing, and do not lead to formal qualifications on the National Qualifications Framework (NQF) – unless stated otherwise. Delegates who successfully complete a short course and comply with the related assessment criteria (where applicable) are awarded certificates of successful completion and/or attendance by the University of Pretoria.

This course is ECSA and SACNASP accredited.

Registration and enquiries

Course Coordinator

Modjadji Masola

Tel: +27 (0)12 434 2500

Fax: +27 (0)12 434 2505

Email: info@enterprises.up.ac.za

Course presenter

Prof SW Jacobsz

Department of Civil Engineering

Shifting knowledge to insight

 www.enterprises.up.ac.za

 +27 (0)12 434 2500  +27 (0)12 434 2505  info@enterprises.up.ac.za  Private Bag X41, Hatfield, 0028

For quotations on in-house training, email quote@enterprises.up.ac.za

Advanced Course in Slope, Seepage and Foundation Analysis

Presented by the Department of Civil Engineering, University of Pretoria

Course programme

Day 1: Monday 14 February 2022

08:00–10:00	The principles of elasticity Hook's law Elastic material parameters Elasticity in one, two and three dimensions Isotropy and anisotropy Plane-strain, radial symmetry and 3D conditions
10:00–10:30	Coffee/Tea break
10:30–12:30	The principles of plasticity Yield criteria (Mohr-Coulomb, von Mises, Tresca, Drucker Prager) Associated and non-associated flow rules Hardening laws (perfectly plastic, strain hardening and strain softening materials)
12:30–13:30	Lunch
13:30–15:30	The principles of plastic limit analysis The theorems of plastic collapse Requirements for an exact solution Upperbound analysis using plastic mechanisms and principle of virtual work
15:30–16:00	Coffee/Tea break
16:00–17:00	The principles of plastic limit analysis (cont.) Upperbound example problems Upperbound analysis using software Lower bound analysis with stress discontinuities and stress rotation using Mohr circles

Day 2: Tuesday 15 February 2022

08:00–10:00	The principles of plastic limit analysis (continued) Upper and lowerbound plasticity example problems Introduction to slip line theory
10:00–10:30	Coffee/Tea break
10:30–12:30	Limit equilibrium analysis The principles of limit equilibrium analysis Solving example problems using limit equilibrium analysis Limit equilibrium methods in slope stability analysis (Fellenius, Bishop, Janbu, Morgenstern-Price, etc)
12:30–13:30	Lunch
13:30–15:30	Limit equilibrium analysis (continued) The principles of "enhanced limit equilibrium" analysis using numerical analysis The strength reduction technique for geotechnical stability analysis using numerical analysis
15:30–16:00	Coffee/Tea break
16:00–17:00	Finite difference techniques for the solution of Consolidation problems Seepage problems Implementation in spreadsheets

Shifting knowledge to insight

 www.enterprises.up.ac.za

 +27 (0)12 434 2500  +27 (0)12 434 2505  info@enterprises.up.ac.za  Private Bag X41, Hatfield, 0028

For quotations on in-house training, email quote@enterprises.up.ac.za