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Introduction to Critical State Soil Mechanics

Presented by the Department of Civil Engineering, University of Pretoria

Brief description

The aim of the **Theoretical Soil Mechanics** short course is to provide practicing engineers with a sound understanding of critical state soil mechanics. The theory of consolidation and shear behaviour of soil can be unified within the framework of critical state soil mechanics. Important aspects such as stress invariants and stress paths will be revised before developing the concept of a state boundary surface and its application to describe the behaviour of normally and over-consolidated soil. Themes that will be covered include the critical state line, Roscoe surface, Hvorslev surface, drained and undrained planes and elastic walls. Concepts such as a yield surface, hardening law and flow rule will be introduced before presenting the Cam Clay and NorSand models.

Postgraduates students registered for the Honours Degree in Geotechnical Engineering are required to attend the course and pass the examination for Theoretical Soil Mechanics SGS 788. There is no formal evaluation of other course attendees.

Course content

- Stresses and strains in soil. Stress invariants and strain invariants. Stress paths
- Compression and shear behaviour of soils
- The Roscoe and Hvorslev surfaces. The Critical State concept
- The behaviour of sands and development of a flow rule
- Introduction to plasticity theory, the Cam Clay and NorSand models.

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Introduction to Critical State Soil Mechanics

Presented by the Department of Civil Engineering, University of Pretoria

Course programme

Day 1

08:00–10:00	•	Introduction
	•	Mohr circles and stress invariants Stress paths
	•	The octahedral plane and triaxial stress space
10:00–10:30		**Coffee/Tea break**
10:30–12:30	•	Ideal elastic soil
	•	Uncoupled elastic constitutive model
	•	Compression of soil
	•	Behaviour of soil during shear
12:30–13:30		**Lunch**
13:30-16:00	•	The critical state concept
	•	The Roscoe surface
	•	The Hvorslev surface

Day 2

08:00–10:00	•	The behaviour of sand
	•	Dilation and the development of a flow rule
10:00–10:30		**Coffee/Tea break**
10:30–12:30	•	The Cam Clay model Calculation of elastic and plastic strains
12:30–13:30		**Lunch**
13:30-16:00	•	Modified Cam Clay
	•	Stress-dilatancy
	•	Nor-Sand Model

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Introduction to Critical State Soil Mechanics

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Learning Outcomes

After successfully completing this course, you should:

- ☑ have a thorough understanding of the critical state concept and its application in geotechnical engineering, including an understanding of:
- ☑ stress invariants, stress paths and the state boundary surface
- ☑ plasticity theory and the Cam Clay and NorSand models,
- ☑ be able to plot stress paths for drained and undrained loading of soil and calculate the deviatoric stress, mean effective stress, void ratio and pore pressure at failure
- ☑ be able to use plasticity theory to calculate elastic and plastic strains of soil during shear.

Course delivery mode options:

Blended

Who should enrol?

This course is required if you are a postgraduate student studying towards your Honours Degree in Geotechnical Engineering at the University of Pretoria. In addition, the course is aimed at civil engineering and engineering geology graduates who have completed undergraduate courses in soil mechanics, as well as senior engineers interested in improving their knowledge of Theoretical Soil Mechanics.

Entry Requirements:

Prospective delegates should ideally hold a degree in civil engineering or engineering geology. An undergraduate knowledge of soil mechanics is required

Course dates

12-13 February 2024

Disclaimer: For low-income countries we use the World Bank definition which can be accessed here.

Programme fees

Face to face in Pretoria:
R7 000.00 per delegate (VAT incl.)
Online: R3 500.00 per delegate (VAT incl.)
Online (Low Income Countries):
R1 750.00 per delegate (VAT incl.)

Course fees include all course material, refreshments and lunch during contact days. 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

Accreditation and certification

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Registration and enquiries

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Programme leader

Prof. Gerhard Heymann
Department of Civil Engineering
Email: gerhard.heymann@up.ac.za

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University of Pretoria

Introduction to Unsaturated Soil Mechanics

Presented by the Department of Civil Engineering, University of Pretoria

2 ECSA CPD Points

Brief description

The Introduction to **Unsaturated Soil Mechanics** is a one-day course focusing on the theoretical framework and practical aspects of unsaturated soil mechanics in geotechnical engineering. The emphasis is on fundamental principles, stress state variables, steady-state and transient flows, soil-water characteristics, theory of shear strength and its measurement, soil stiffness, plastic and limit equilibrium analyses of earth pressures, slope stability and bearing capacity. Attention will be paid on how to extend classical saturated soil mechanics to encompass unsaturated soil behaviour. Engineering applications and the application of unsaturated soil mechanics in design are also discussed.

The aim of this course is to enable students, researchers and engineers to understand the fundamental principles and advanced concepts of unsaturated soil mechanics and their applications to geotechnical and geo-environmental engineering problems such as landfill cover systems, concrete block retaining walls, embankment, etc.

The course is presented by Dr Talia da Silva Burke. Talia is a senior lecturer at the University of Pretoria, and registered professional engineer. She completed her PhD at the University of Cambridge on a Gates Cambridge Scholarship where she researched the behaviour of geosynthetic-reinforced soils above voids. Talia has worked in consulting specialising in geo-environmental engineering with Jones & Wagener and as a Research Associate at the University of Cambridge researching piled foundations in expansive clays.

Entry Requirements:

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

Course delivery mode options:

Contact sessions will be held in Hatfield Pretoria.

Course dates

Face to face in Pretoria: 14 February 2024

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Introduction to Unsaturated Soil Mechanics

Presented by the Department of Civil Engineering, University of Pretoria

Course Content

The below topics will be covered in the course:

- State variables and measurement of soil suction
- Introduction to the fundamental principles of unsaturated soil mechanics and the soil water characteristic curve
- Seepage and unsaturated permeability
- Unsaturated shear strength and stiffness theory and measurements
- Volume change and deformation, including Barcelona Basic Model
- Engineering applications of unsaturated soil mechanics

Learning Outcomes

After successfully completing this course, you should have a basic understanding of the fundamental principles of unsaturated soil mechanics and its application in geotechnical engineering, including an understanding of:

- ☑ definition of unsaturated soils, and identification of scenarios where unsaturated soil mechanics are likely to influence the geotechnical behaviour
- ☑ phases in unsaturated soils, stress state variables, capillarity, surface tension and soil water retention curve
- ☑ measurement of soil suction in the field and laboratory, measurement and fitting of soil water retention and shrinkage curves
- ☑ seepage in unsaturated soils and unsaturated permeability
- ☑ the role of soil suction on shear strength the measurement of unsaturated shear strength
- ☑ plastic and limit equilibrium analyses with a focus on earth pressures, bearing capacity and slope stability
- ☑ the role of soil suction on shear stiffness and unsaturated shear stiffness measurement
- ☑ the application unsaturated soil mechanics on geotechnical and geo-environmental engineering problems, such as slope stability, temporary trench excavations, and landfill cover systems including capillary barriers.

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Introduction to Unsaturated Soil Mechanics

Presented by the Department of Civil Engineering, University of Pretoria

Who should enrol?

This course is ideal 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 unsaturated soil mechanics, or
- an engineer who wishes to expand your background in the engineering applications relating to unsaturated soils.

Programme fees

Face to face in Pretoria:
R5 500.00 per delegate (VAT incl.)

Online:
R2 750.00 per delegate (VAT incl.)

Online (Low Income Countries):
R1 375.00 per delegate (VAT incl.)

Course fees include all course material, refreshments and lunch during contact days. 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

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Registration and enquiries

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Course Leader

Prof. SW Jacobsz
Email: sw.jacobsz@up.ac.za
Department of Civil Engineering

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Programme leader

ENTERPRISES
University of Pretoria

In-situ Geotechnical Testing and Tailings Applications

Presented by the Department of Civil Engineering, University of Pretoria

2 ECSA CPD Points

Brief description

The **In-situ Geotechnical Testing and Tailings Applications** short course will refresh your knowledge of in-situ geotechnical testing while also introducing you to new developments in the field. The course focuses on the most widely used tests and applications, including the Standard Penetration Test (SPT), Cone Penetration Test (CPT), Piezocone (CPTu) and seismic tests. During the course, you will also explore the interpretation of test results and its application in geotechnical problems in further detail to expand your knowledge of and skills in the application of each test based on established parameters, as well as direct and indirect test design methods.

Course Content

- Detail discussion of SPT, CPT, CPTu CSW, SASW, MASW, cross-hole test and downhole test.
- Interpretation of these tests to derive basic soil properties.
- Application of direct design methods.
- Flow regime and consolidation analysis from CPTu data.
- Foundation settlement calculation using small strain stiffness.

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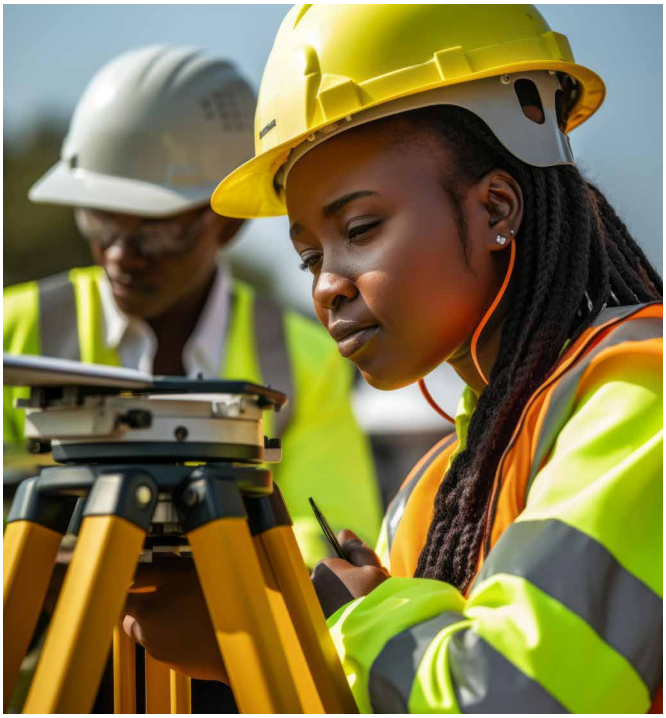
In-situ Geotechnical Testing and Tailings Applications

Presented by the Department of Civil Engineering, University of Pretoria

Learning Outcomes

After successfully completing this course, you should have a thorough understanding of the SPT, CPT, CPTu and seismic tests and their application in geotechnical engineering, including an understanding of standard test procedure for these tests interpretation of these tests to derive basic soil properties to be used in indirect design methods flow and consolidation parameters from the CPTu, as well as the application of these parameters small-strain stiffness and its application understand the application of direct design methods such as those developed by Schmertmann, Schultze and Sherif, as well as Burland and Burbidge have an understanding of the application of the derived parameters in design know how and when to apply N, N1 and (N1)60 be able to derive a complex flow regime from CPTu dissipation data carry out consolidation analysis from derived parameters and the determination of the drainage path from CPTu data carry out interpretation of complete as well as incomplete dissipation tests conduct settlement calculation using small strain stiffness, and have a basic understanding of liquefaction analysis using seismic data. Postgraduates students registered for the Honours Degree in Geotechnical Engineering are required to attend the course and pass the examination for Specialised Geotechnical Testing SGS 789. There is no formal evaluation of other course attendees.



Course delivery mode options:

Blended

Who should enrol?

This course is required if you are a postgraduate student studying towards an Honours degree in Geotechnical Engineering at the University of Pretoria. In addition, the course is aimed at civil engineering and engineering geology graduates who have completed undergraduate courses in soil mechanics, as well as senior engineers interested in improving their knowledge of geotechnical in situ testing techniques.

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In-situ Geotechnical Testing and Tailings Applications

Presented by the Department of Civil Engineering, University of Pretoria

Entry Requirements:

Prospective delegates should ideally hold a degree in civil engineering or engineering geology. Undergraduate knowledge of soil mechanics is required.

Course dates

15-16 February 2024

Programme fees

Face to face in Pretoria:
R7 000.00 per delegate (VAT incl.)

Online:
R3 500.00 per delegate (VAT incl.)

Online (Low Income Countries):
R1 750.00 per delegate (VAT incl.)

Course fees include all course material, refreshments and lunch during contact days. 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

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Programme leader

Prof Gerhard Heymann
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Risk and Reliability Analysis in Geotechnical Engineering

Presented by the Department of Civil Engineering, University of Pretoria

1 ECSA CPD Points

Brief description

The **Reliability Methods in Geotechnical Engineering** course comprises part of the taught component of a postgraduate subject, Analytical Soil Mechanics SGS 787, taught as part of the Honours Degree in Geotechnical Engineering at the University of Pretoria.

Analysis techniques used in geotechnical engineering typically estimate the collapse load or the factor of safety applicable to a boundary value problem. However, the magnitude of the collapse load or the factor of safety does not provide information on the probability of failure. It is often the probability of failure, more so than the actual factor of safety, that is important for engineers and their clients. In this course a number of techniques are introduced for the calculation of the probability of failure. A working knowledge of basic statistical principles is assumed, but important concepts will be briefly reviewed. Postgraduates students registered for the Honours Degree in Geotechnical Engineering are required to attend the course and pass the examination for Analytical Soil Mechanics SGS 787. There is no formal evaluation of other course attendees.

Course content

- An overview of basic statistical principles and reliability relevant to the course
- The Point Estimate Method
- Monte Carlo Analysis
- FORM optimisation technique for reliability analysis

Entry Requirements:

Prospective delegates should ideally hold a degree in civil engineering or engineering geology. Undergraduate knowledge of soil mechanics and statistics is recommended.

Who should enrol?

This course is ideal for you if you are:

- an Honours student in Geotechnical Engineering (civil engineers and engineering geologists)
- a civil engineering and engineering geology practitioner who has completed undergraduate courses in soil mechanics, with some knowledge of statistics and you would like to expand your knowledge
- an engineer and engineering geologist from in dustry who wishes to expand their background in reliability analyses, and
- an engineer who does not necessarily satisfy the academic requirements to be admitted to the Honours Degree program.

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Risk and Reliability Analysis in Geotechnical Engineering

Presented by the Department of Civil Engineering, University of Pretoria

Learning Outcomes

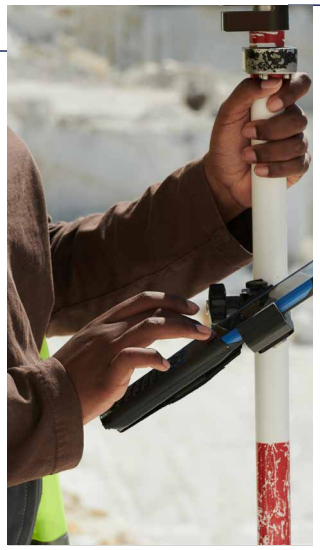
After successfully completing this course, you should:

Have a basic understanding of the statistical principles of reliability including

- an ability to plot probability density functions from data
- knowledge and understanding of the normal, log-normal, uniform and exponential distributions
- an ability to determine probabilities from abovementioned distributions
- understanding of the importance of correlation
- understanding of the principle behind a performance function
- ability to determine probabilities of failure from normally distributed capacity and demand functions
- understanding of the concept of a reliability index and how it relates to the probability of failure

Have an understanding and be able to apply the Monte Carlo Analysis Method, including

- generation of sets of random numbers with specified statistical distributions and correlations
- implementation of the technique in a spreadsheet or computer program
- determination of the required number of analysis steps to obtain a convergent solution



Have a basic understanding and be able to apply the FORM optimisation technique for the determination of reliability, including

- understanding how the probability density of a performance function can be represented in multi-variate space
- expression of the reliability index for multi-variate problems using the Hasofer-Lind method
- implementation of the FORM technique in a spreadsheet and applying the solver function to solve practical multi-variate reliability problems

Have an understanding and be able to apply the Point Estimate Method, including

- understanding how moments represent the properties of a statistical distribution
- understanding how a probability distribution can be represented by a system of point estimates
- determination of moments (and hence expected values, variances and probabilities) from point estimates
- application of the PEM to problems of one, two and three and multiple random variables

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Risk and Reliability Analysis in Geotechnical Engineering

Presented by the Department of Civil Engineering, University of Pretoria

Course programme

08:00–10:00

Overview of basic statistical principles and reliability

- Plotting probability density functions from data
- The normal, log-normal, uniform and exponential distributions
- Determination of probabilities from distributions
- The importance of correlation
- Introducing performance functions
- Probabilities of failure from normally distributed capacity and demand functions
- The concept of the reliability index and the relationship with to the probability of failure

10:00–10:30 Coffee/Tea Break

10:30–12:30

The point estimate methods

- The representation of the properties of a statistical distribution using moments
- The representation of a probability distribution with a system of point estimates
- Determination of moments (and hence expected values, variances and probabilities) from point estimates
- Application of the PEM to problems of one, two and three and multiple random variables

12:30–13:30 Lunch

13:30–14:30

Monte Carlo Analysis

- Introduction to the method
- Generation of sets of random numbers with specified statistical distributions and correlations
- Implementation of the technique in a spreadsheet or computer programme
- Determination of the required number of analysis steps

14:30–15:00 Coffee/Tea Break

15:00–17:00

FORM optimisation technique for reliability analysis

- Representing the probability density of a performance function in multi-variate space
- Expression of the reliability index for multi-variate problems using the Hasofer-Lind method
- Implementation of the FORM technique in a spreadsheet and applying the solver function to solve practical multi-variate reliability problems.

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Risk and Reliability Analysis in Geotechnical Engineering

Presented by the Department of Civil Engineering, University of Pretoria

Course delivery mode options:

Blended

Course dates

11 June 2024

Programme fees

Face to face in Pretoria:
R5 500.00 per delegate (VAT incl.)

Online:
R2 750.00 per delegate (VAT incl.)

Online (Low Income Countries):
R1 375.00 per delegate (VAT incl.)

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Registration and enquiries

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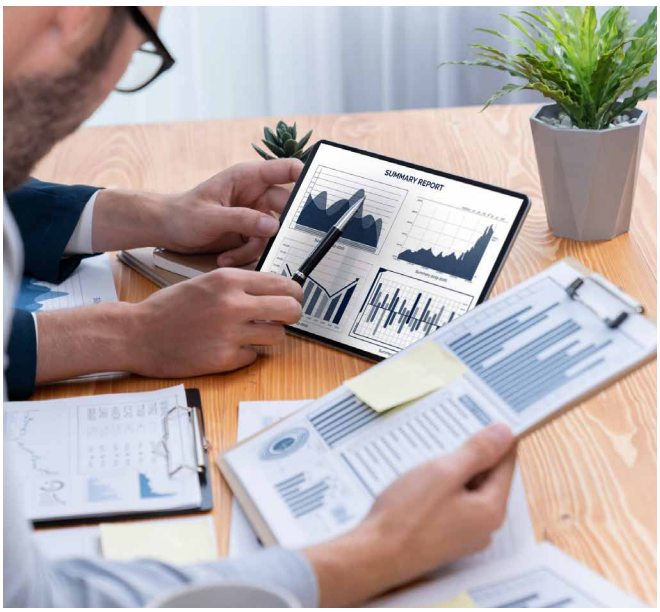

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Geotechnical Laboratory Testing

Presented by the Department of Civil Engineering, University of Pretoria

1 ECSA CPD Point

Brief description

The **Geotechnical Laboratory Testing** short course is aimed at civil engineering and engineering geology practitioners who want to improve their knowledge on the specification of geotechnical soil tests, interpretation of the data and judgement of the quality of laboratory test results. Laboratory tests that will be dealt with during the course include the triaxial test, shearbox test, oedometer test and Rowe cell test. The application of stress paths to describe the behaviour of soil will be discussed and examples of typical stress paths will be presented. This course comprises part of the taught component of a postgraduate subject, Specialised Geotechnical Testing SGS 789, taught as part of the Honours Degree in Geotechnical Engineering at the University of Pretoria. Postgraduates students registered for the Honours Degree in Geotechnical Engineering are required to attend the course and pass the examination for Specialised Geotechnical Testing SGS 789. There is no formal evaluation of other course attendees.

Course Content

- Instrumentation for laboratory testing
- Geotechnical soil tests including the triaxial test, shearbox test, oedometer test and Rowe cell test
- Evaluation of typical stress paths for soil
- Overview of typical strength, stiffness and permeability values of soils and how to recognise poor test result
- Sampling of soils

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Geotechnical Laboratory Testing

Presented by the Department of Civil Engineering, University of Pretoria

Course programme

08:00–10:00	• Classification of laboratory tests • Stress paths • Field vs. laboratory stiffness
10:00–10:30	Coffee/Tea break
10:30–12:30	• Stages of a triaxial test, B-value, rate of shear • Triaxial permeability test • Shearbox test • One dimensional consolidation tests • Oedometer test and Rowe cell test • Bender element tests
12:30–13:30	Lunch
13:30–15:30	• Geotechnical parameters for different tests. • Typical soil parameters • Identification of poor test results
15:30–16:00	Coffee/Tea break
16:00–17:00	• Sampling techniques • Specification of geotechnical testing

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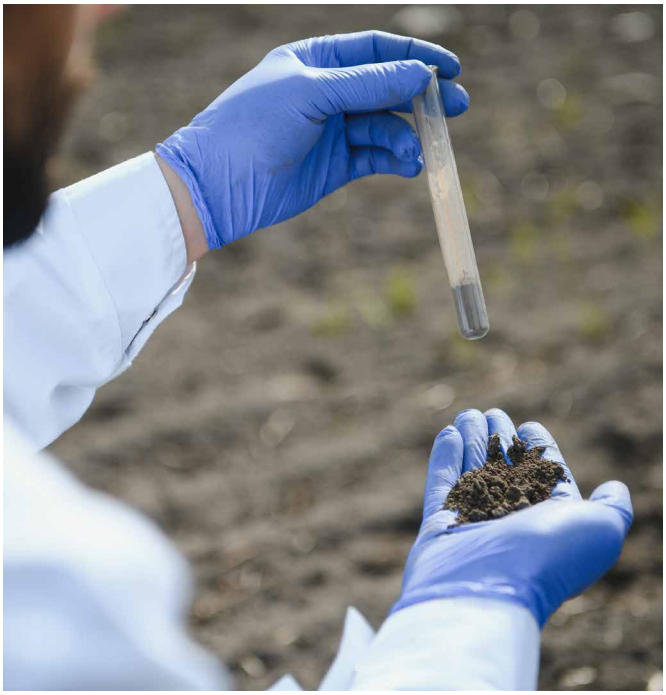

Course programme

After successfully completing this course, you should:

- ☑ be able to specify the appropriate test and drainage conditions for different geotechnical conditions
- ☑ be able to identify typical stress paths for different soil types
- ☑ understand the importance of instrumentation in the context of laboratory testing of soils
- ☑ recognise poor laboratory test data, and
- ☑ understand the advantages and limitations of different soil sampling techniques.

Course delivery mode options:

Blended

Who should enrol?

This course is ideal for you if you are:

- a post graduate students studying towards their Honours Degrees in Geotechnical Engineering at the University of Pretoria, or
- a civil engineering or engineering geology graduate who has completed an undergraduate course in soil mechanics, or
- a senior engineer interested in improving your knowledge of geotechnical laboratory testing.

Entry Requirements:

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

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Geotechnical Laboratory Testing

Presented by the Department of Civil Engineering, University of Pretoria

Course date

12 June 2024

Programme fees

Face to face in Pretoria:
R5 500.00 per delegate (VAT incl.)

Online:
R2 750.00 per delegate (VAT incl.)

Online (Low Income Countries):
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Course fees include all course material, refreshments and lunch during contact days. 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

Accreditation and certification

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Registration and enquiries

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Programme leader

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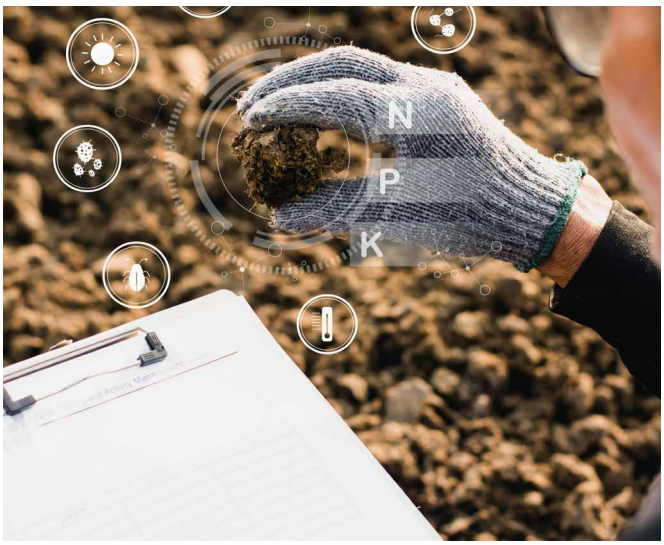

Shifting knowledge to insight

ENTERPRISES
University of Pretoria

Advanced Course in Slope, Seepage and Foundation Analysis

Presented by the Department of Civil Engineering, University of Pretoria

5 ECSA CPD Points

Brief description

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

Entry Requirements:

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

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 back ground in the analytical techniques covered in the course.

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University of Pretoria

Advanced Course in Slope, Seepage and Foundation Analysis

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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 an understanding, and the ability to implement in a spreadsheet, finite difference techniques for the solution of
- consolidation problems
- seepage problems

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.

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University of Pretoria

Advanced Course in Slope, Seepage and Foundation Analysis

Presented by the Department of Civil Engineering, University of Pretoria

Course programme

Day 1: 13 June 2024

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: 14 June 2024

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

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ENTERPRISES
University of Pretoria

Advanced Course in Slope, Seepage and Foundation Analysis

Presented by the Department of Civil Engineering, University of Pretoria

Course delivery mode options:

Blended

Programme fees

Face to face in Pretoria:
R7 000.00 per delegate (VAT incl.)

Online:
R3 500.00 per delegate (VAT incl.)

Online (Low Income Countries):
R1 750.00 per delegate (VAT incl.)

Course fees include all course material, refreshments and lunch during contact days. 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

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Course dates

13-14 June 2024

Accreditation and certification

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Registration and enquiries

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Programme leader

Prof SW Jacobsz
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ENTERPRISES
University of Pretoria

Introduction to Geotechnical Design of Tailings Dams

Presented by the Department of Civil Engineering, University of Pretoria

Brief description

The **Introduction to Geotechnical Design of Tailings Dams** is a two-day course focusing on the theoretical framework and practical aspects of assessing the stability of tailings dams in the context of applicable regulatory requirements and industry best practices. The course gives a review of critical state soil mechanics which is fundamental to the appropriate interpretation of the state of the dam. The concepts of drained and undrained shear strength and related slope stability are presented, together with techniques for the appropriate specification and interpretation of laboratory and in situ testing as required for these analyses.

The aim of the course is to equip junior geotechnical engineers with the knowledge and framework to understand the complexity of geotechnical design of tailings dams, and to provide techniques and tools to appropriately conduct such designs. The course is presented by the Geotechnical Engineering group at the University of Pretoria, led by the academic group of Prof. Gerhard Heymann, Prof. SW Jacobsz and Dr Talia da Silva Burke. Additional expert presentations will be given by Prof. Eben Rust and other members of the Geotechnical Engineering group involved with advanced testing and research in tailings.

Course content

- Case histories of tailings dam failures
- Guidelines and legislation for tailings dam design
- Critical state soil mechanics and application to tailings dams
- Drained and undrained shear strength of tailings
- Sampling and laboratory testing of tailings materials
- In situ testing of tailings using Cone Penetration Tests (CPT)
- Drained and undrained stability analysis of tailings dams
- Tailings dam break analysis

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University of Pretoria

Introduction to Geotechnical Design of Tailings Dams

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 fundamental principles of geotechnical design of tailings and the relevant legislative framework including an understanding of:

- ☑ Significant local and international tailings dam failures, the fundamental reasons for these failures and impact of each event;
- ☑ available documents for international best practice in the design, construction, operation and management of tailings dams;
- ☑ relevant local legislation governing the geotechnical design of tailings dams in South Africa;
- ☑ critical state soil mechanics, application of the state parameter to tailings, and the NorSand critical state model;
- ☑ drained and undrained shear strength of tailings, including the characterisation of brittle behaviour, and available estimates of peak and residual undrained shear strength ratios;
- ☑ appropriate techniques to sample and transport tailings material;
- ☑ appropriate specifications and techniques for high-quality laboratory testing and interpretation of results, including triaxial testing for critical state parameters and direct simple shear tests;
- ☑ appropriate specifications and techniques for high-quality in situ testing of tailings and interpretation of results; and
- ☑ breach (dam break) analysis of tailings.

Course delivery mode options:

Blended - Course will be both online and in contact
Contact - Course will be in Pretoria

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ENTERPRISES
University of Pretoria

Introduction to Geotechnical Design of Tailings Dams

Presented by the Department of Civil Engineering, University of Pretoria

Who should enrol?

Engineers/geologists working in any aspects of tailings dams.

Entry Requirements:

A civil engineering or engineering geology graduate who has completed undergraduate courses in soil mechanics.

Course dates

11 November 2024 -12 November 2024

Programme fees

Face to face in Pretoria:
R7 000.00 per delegate (VAT incl.)
Online:
R3500.00 per delegate (VAT incl.)
Online (Low Income Countries only):
R1750.00 per delegate (VAT incl.)

Course fees include all course material, refreshments and lunch during contact days. 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

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Department of Civil Engineering

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