



**UNIVERSITY OF PERADENIYA
DEPARTMENT OF CIVIL ENGINEERING**

POSTGRADUATE PROGRAMME IN GEOTECHNICAL ENGINEERING

YEAR 2022

Applications are invited for the Postgraduate Programme in Geotechnical Engineering for the year 2022. Programme will be commenced from February 2022.

1. INTRODUCTION

The postgraduate programme in Geotechnical Engineering is conducted by the Department of Civil Engineering, University of Peradeniya is intended for graduates with an engineering background and practicing civil engineers in the field of Geotechnical Engineering or graduates looking for postgraduate opportunities in Geotechnical Engineering. The course consists of course units conducted through lectures, tutorials, assignments, laboratory classes, field testings and research projects.

The objectives of the postgraduate courses are to provide the students with

- a) advanced knowledge in the aspects of Geotechnical Engineering applied to the industry or further research.
- b) an exposure and hands-on experience in the use of various research and application-oriented computer software packages in the field of Geotechnical Engineering.

Department of Civil Engineering, University of Peradeniya has excellent testing facilities for laboratory and fieldwork related to Geotechnical Engineering. Facilities available at the laboratories are Computing Centre with state-of-the-art high-performance workstations to run numerical simulations and large-scale and conventional testing apparatus. The Library of the Faculty of Engineering is available for students at any time during the period of study. The staff of the Civil Engineering Department at the Geotechnical Engineering associated with the postgraduate programme in Geotechnical Engineering are:

Prof. K. G. H. C. N. Seneviratne	BScEng, PhD
Prof. S. B. S. Abayakoon	BScEng, MAsc, PhD
Dr. L.C. Kurukulasuriya	BScEng, M Eng., PhD
Dr. D. de. S. Udakara	BScEng, M Eng, PhD
Dr. S. K. Navaratnarajah	BScEng, MSc Eng, PhD
Dr. M.C.M. Nasvi	BScEng, PhD
Dr. T. K. K. C. Deepagoda	BScEng, MSc Eng, PhD
Dr. A. M. R. G. Athapaththu	BScEng, MPhil, DEng

In addition, visiting experts from the industry and local universities will also be involved in the conduct of lectures, seminars, case studies and discussions.

2. PROGRAM STRUCTURE, DURATION AND COURSES

In order to obtain the required credits, it is essential to conduct classes for at least 6 sessions. Accordingly, the proposed timetable for the program is as follows;

Day	Time
Saturday	8.00AM to 11.00 AM
	12.00 PM to 3.00 PM
	3.00 PM to 5.00 PM
Sunday	8.00 AM to 11.00 AM
	12.00 PM to 3.00 PM
	3.00 PM to 5.00 PM

Note. In addition to the above sessions, all students will complete an Advanced study/ Research study/ Advanced Research Study of his/her choice related to the course. The discussions and meetings will be scheduled from time to time (not every week) on Friday, Saturday or Sunday.

Accordingly, the proposed schedule for the course is as follows;

Semester/Course	Period of the year
Term I	February to June (5 months)
Term II	July to November (5 months)
Independent Study/ Advanced study/ Advanced Research Study	Term I and Term II and then Continue after November

Examinations in respect of the subjects taught in a term will be held within the term, and the progress of the research projects are continuously evaluated during and at the end of each term. At the end of Term II, the student will complete taught courses as required.

Item	Description	Number of credits
1	From compulsory courses (4 courses \times 3 credits + 2 courses \times 2 credits)	16
2	From optional courses:	
	PGDip (SLQF Level 8)	6
	MEng (SLQF Level 9)	9
	MScEng (SLQF Level 10)	14

2.1 Courses Offered (Subject to approval)

CE 6101 RESEARCH METHODS IN CIVIL ENGINEERING (Optional)

Fundamentals of Research: Definition and Objectives of Research; Qualitative vs Quantitative Research; The Scientific Research Process; Identification, selection, and formulation of research problems; Characteristics of good research problems; Review of literature. **Data Collection, Analysis and Presentation:** Methods and techniques of data collection; Design of Experiments; Sampling and sampling designs; Statistical modelling and analysis including introduction to statistical package; Probability Distributions; Multivariate methods; Concepts of correlation and regression, error analysis; Effective presentation of information using Tables, illustrations, graphs, etc. **Scientific writing and presentation:** Essential components of abstract, introduction, literature review, materials and methods, results, discussion, and conclusions; Formatting of contents; Methods of referencing and the use of referencing tools, Preparing and presenting a technical presentation.

CE 6301 ENGINEERING GEOLOGY AND ROCK MECHANICS (Compulsory)

Engineering classification of rock masses: Rock Quality Designation (RQD), Rock structure rating (RSR) , Rock Mass Rating (RMR), and Slope Mass Rating (SMR) in engineering classification of rock masses. **Engineering properties of rocks:** Physical, mechanical, hydraulic and chemical properties of Rock masses, general range of values in different rock types. **Construction materials and energy sources:** Different types of coarse aggregates for civil engineering projects, sources of aggregates, selection of suitable materials for construction purposes, introduction to energy sources such as coal, petroleum, gas and geothermal sources. **Geological consideration for civil engineering projects:** Selection of suitable sites for dams and reservoir projects, tunnels and underground openings, roads, bridges and other constructions, Effect of geological structures and types of foundation on rock. **Failure criteria of rocks:** Theory of rock failures, failure criterion for rocks, Introduction to stereographic analysis , use of stereo-nets for stability analyses. **Underground excavations and rock supports:** Design for tunnel supports on the basis of rock classification.

CE 6302 ADVANCED FOUNDATION ENGINEERING (Compulsory)

Shallow foundations: Bearing capacity theories, Shallow foundation design using Eurocode 7, eccentric and inclined loads, bearing capacity on slopes, Bearing capacity of layered soils, foundation settlements. **Design of combined and raft foundations:** flexible and rigid design of combined footings and raft foundations. **Machine foundations:** Types of machines, design criteria, elements of vibration theory, governing equations. **Deep foundations:** Introduction, bearing capacity of group piles, Quality Control and Quality assurance of pile foundation, Design of deep foundations using Eurocode 7, Negative skin friction, Pile group settlement, Rock socketed piles, Laterally loaded piles, Piles subjected to uplift, Design of Caissons in sand and clay. **Design Exercise:** Design of foundation of a building.

CE 6303 SLOPE STABILITY AND EARTH RETAINING STRUCTURES (Compulsory)

Mass movements: Classification, causative factors, instrumentation, preventive, remedial and control measures. **Slope Stability Analysis using EC7:** EC7 guidelines for slope stability analysis, Design of slopes to EC7, Limit equilibrium methods, Bishop and Morgenstern Chart. **Design of rigid and flexible earth retaining structures using EC7:** Lateral earth pressure: Rankine's and Coulomb's theory, Introduction to earth retaining structures, EC7 guidelines for designing earth retaining structures, Design of mass concrete retaining wall and cantilever retaining wall to EC7. Introduction to sheet pile walls (Cantilever and anchored sheet pile walls), EC7 guidelines for sheet pile wall design, Fixed and free earth support methods of design of anchored sheet pile walls. Analyse internally stabilized earth walls (MSE walls), Soil nailing. **Case study on slope and retaining failure:** Case studies on slope and retaining wall failures.

CE 6304 PROBLEMATIC SOILS AND GROUND IMPROVEMENT (Compulsory)

Problematic soils: Collapsible soils - formation, types, identification methods, construction techniques; **Expansive soils** - identification, testing, swell potential, construction techniques; **Peat** - formation, types, construction techniques; **sanitary landfills** - introduction, settlement

considerations. **Geosynthetics:** Types and applications of geosynthetics, Testing geosynthetics to evaluate physical, mechanical and hydraulic properties, designing for drainage, filtration and reinforcement. **Ground Improvement techniques:** Importance of ground improvement, prerequisites for ground improvement, common ground improvement methods: surface and deep compaction, sand columns, preloading and vertical drains, dynamic consolidation, geotextiles, mechanical and chemical stabilization, preliminary design considerations in ground improvement methods.

CE 6305 APPLICATION OF NUMERICAL METHODS IN GEOTECHNICAL ENGINEERING

(Compulsory)

Basic Numerical Methods: Finite difference method (FDM), finite element method(FEM), boundary element method (BEM), discrete element method (DEM). **Models of soil behaviour:** Model soil behaviour using linear elastic, Mohr-Coulomb, modified Cam Clay. Selection of material parameters for analysis. **Use of Numerical software:** GeoStudio (eg. Slope/W, Sigma/W and Seep/W to analyse slopes, stress-strain and seepage respectively) and PLAXIS (eg. to analyse shallow foundation, deep foundation and embankments).

CE 6306 SITE INVESTIGATION, TESTING AND INSTRUMENTATION

(Compulsory)

Planning of exploration: Planning an exploration program, methods of exploration, exploration for preliminary and detailed design, spacing and depth of bores, data presentation. **Exploration techniques:** Methods of boring and drilling, limitations of various drilling techniques, stabilization of boreholes, bore logs. **Soil and rock sampling:** Disturbed and undisturbed sampling. **Laboratory and Field Testing of soils:** Testing procedure, limitations, correction and data interpretation of laboratory and field testing methods. **Field Instrumentation and Monitoring:** Field instrumentation for load, displacement and pore pressure measurements, Monitoring and interpretation of field measurements.

CE 6307 EARTH AND ROCKFILL DAMS

(Optional)

Types and Features of Earth and Rockfill Dams: Different types of earth and rockfill dams, Functions of earth and rockfill dams, Controlling factors in the selection of dam types, Failures and Damages of embankment dams, Shear strength of embankment. **Design considerations of Earth and Rockfill Dams:** Selection of a dam type, Types of slope protection, Selection of type of slope protection, Foundation Design of rockfill dams, Modification of existing dams. **Treatment for Earthfill Dams:** Foundation treatment of earth-fill dams, Shaping of foundations, Excavation dewatering. **Protective Filters in Earth and Rockfill Dams:** Filter types, Drainage and Transition Filters, Design of filters. **Seepage through Dams:** Methods of analysis of seepage, Numerical analysis of seepage through dams using software. **Stability Analysis of Dams:** Effective and total stress analysis, Loading conditions, Drawdown analysis, Factor of safety criteria, Numerical methods of analysis for different loading conditions using software. **Construction Aspects and Problems:** Case study on construction aspects of a dam: Study of regional geology, Site inspection, In-situ tests to evaluate strength-deformation and hydraulic characteristics, Remedial works. **Dam Instrumentation and Monitoring:** Instrumentation and Monitoring Considerations, Instrumentation types (seepage, water pressure, earth pressure, deformation), Instrumentation installation and construction considerations.

CE 6308 ENGINEERING GEOLOGICAL EXPLORATION
(Optional)

Methods of geological and geophysical explorations for site selections: Detail investigation methods for large projects such as dams and reservoirs, roads, bridges, tunnel construction and other underground openings, subsurface investigation methods of resistivity survey and seismic refraction survey and analysis. **Field and Laboratory testing of rocks:** Determination of physical, mechanical and hydraulic properties of rock masses, chemical tests for mineral identification, sulphate attack, etc. **Landslide investigation, mapping, prevention and control:** Methods of investigation, methods to stabilize unstable slopes. **Environmental Impact Assessment:** Method of assessment, guidelines for dams and reservoirs, etc. **Solid waste management:** Classification of solid wastes, selection of waste disposal sites, management methods.

CE 6309 GEOLOGY FOR ENGINEERS
(Optional)

Rock types: Rock-forming minerals, metamorphic, igneous rocks, sedimentary rocks. **Geological processes:** structure of the earth, internal and external processes, Theory of plate tectonics, plate boundaries, Earthquakes and volcanoes, weathering and erosion, mass movement, Physical features of ground, land formation. **Geological structures:** Faults, Folds, Joints, and other geological structures. **Geological Maps:** Different types of geological maps, introduction to engineering consideration of rocks and rock distribution.

CE 6310 SOIL MECHANICS AND GEOTECHNICAL ENGINEERING
(Optional)

Soil Deposits and Clay Minerals: Different soil deposits and their engineering properties, Genesis of clay minerals: classification and identification. **Compaction, Swelling and Shrinkage behaviour of Soils:** Problems associated with swelling and shrinkage behaviour of soils, factors influencing swell – shrink characteristics, sensitivity, soil suction, soil compaction: factors affecting soil compaction. **Compressibility, Shear Strength and Permeability of Soils:** Compressibility, shear strength and permeability behaviour of fine and coarse-grained soils, mechanisms and factors influencing engineering properties, liquefaction potential.

CE 6311 THEORETICAL SOIL MECHANICS
(Optional)

Failure Theories: Concepts of yield and failure in soils: Failure theories of von Mises, Tresca and their extended form, their applicability to soils.

Theory of Plasticity: Hardening law, flow rule, bound theorems, mechanism for plane plastic collapse, discontinuities, solutions for undrained and drained loading conditions. **Critical State Soil Mechanics:** The critical state line, Roscoe's surface, Hvorslev's surface, Behaviour of sand: Effects of dilation, Elastic and plastic deformation: Cam clay model, Modified Cam clay model, Soil Parameters for design.

CE 6313 GEO-ENVIRONMENTAL ENGINEERING
(Optional)

Basic characteristics of soils: Soil formation, soil texture, structure, particle and pore networks. Phase relationship, physico-chemical interactions between phases, electrokinetics and double layer theory. **Transport of fluids in soils:** Energy state of water in soil, flow in saturated and unsaturated soils, steady/unsteady flow, governing equations in saturated and unsaturated flow in soil, gas flow in unsaturated subsystems. Governing equations for transport of fluids in soil and groundwater. Introduction to multiphase flow in soil-water-gas systems. **Characterization of environmental contaminants:** Hazardous environmental chemicals, organic and inorganic chemical background in contaminants, analytical methods for physical, chemical and biological characterisation of contaminants. **Contaminant fate and transport in soil and groundwater:** Main contaminant transport mechanisms in subsurface, physical, chemical and biological contaminant transfer in soil, contaminant transport and fate modelling. **Contaminated site characterization and risk assessment:** Preliminary and detailed site investigations, standard risk assessment procedures and methods. **Design and application of site remediation techniques:** Vertical barriers, surface caps, groundwater pumping systems, subsurface drains, soil vapour extraction, electrokinetic remediation, thermal desorption, phytoremediation, pump and treat, permeable reactive barriers, air sparging, landfill cover design and maintenance.

CE 6314 MITIGATION AND CONTROL OF NATURAL GEO-HAZARDS (Optional)

Introduction to Geo-hazards: Different types of geo-hazards, causes for geo-hazards, case studies. **Rockfalls and Landslides:** Classification of mass movements of soils and rocks, failure mechanisms, Investigation and instrumentation, Prevention, control and mitigation, Early warning systems. **Land Subsidence and Sinkholes:** Sinkholes, groundwater depletion. **Volcano and Earthquakes:** Theory of plate tectonics, Volcanoes and Earthquakes. **Salinity intrusion:** Types, causes, mitigation methods. **Manmade hazards:** Eg. - Underground storage of hazardous waste, spill of hazardous materials, mining, landfills.

CE 6315 GEOTECHNICAL CONSTRUCTION (Optional)

Earthmoving: Equipment, Excavation, Lifting, Loading and Hauling. **Piling:** Cast in-situ piles, Driven pile, Quality Control, Handling. **Dewatering and Grouting method:** Cofferdam, Caissons, grouting methods. **Offshore Construction:** Dredging, offshore piling. **Ground Improvement:** Compaction, Dynamic Compaction, Soil stabilisation, preloading, PVD.

CE 6316 FORENSIC GEOTECHNICAL ENGINEERING (Optional)

Forensic Geotechnical and Foundation investigation: Forensic investigation – site visit, non-destructive testing, monitoring, sampling and laboratory testing, report writing. Settlement of structures - types of structures, causes of settlement, allowable settlement. Expansive soil – swelling, types of expansive soil movements, foundation design for expansive soil, pavements. Lateral movement - rock falls, slope failures, landslides, retaining walls, deep excavations, ground improvement, dam failures. Groundwater and moisture problems - moisture migration through floor slabs, moisture migration through basement walls, pipe breaks, surface drainage. **Repairs and crack diagnosis:** Repair of slab-on-grade foundations - reinforced mat, partial removal/strengthening of foundation, concrete crack repairs. Repair of slope failures - Rebuilding, geogrid, soil-cement repair, pipe piles. Crack diagnosis - introduction, pavement cracks, cracks in walls, foundation cracks, ground cracks and fissures.

3. ADMISSION REQUIREMENTS FOR THE PROGRAMMES

The postgraduate programmes leading to the following qualifications are available in the postgraduate programmes in Geotechnical Engineering

Postgraduate Diploma in Geotechnical Engineering (SLQF L8): *PGDip (Geotechnical Engineering)*

Degree of Master of Engineering in Geotechnical Engineering (SLQF L9): *MEngGeotech*

Degree of Master of the Science of Engineering in Geotechnical Engineering (SLQF L10): *MScEng (Geotechnical Engineering)*

The minimum qualifications required of a person for admission to postgraduate programmes leading to the SLQF L8, SLQF L9 and SLQF L10 are as follows:

3.1 Postgraduate Diploma in Geotechnical Engineering (SLQF L8): *PGDip (Geotechnical Engineering)*

- (a) A first Degree in Engineering (SLQF L5), acceptable to the Faculty Higher Degrees Committee (FHDC) or
- (b) Such other qualifications equivalent to a first Degree in Engineering (SLQF L5) as may be recommended by the Faculty Higher Degrees Committee as suitable for candidature for PGDip, in a field related to the programme of study.

3.2 Degree of Master of Engineering in Geotechnical Engineering (SLQF L9): *MEngGeotech*

- (a) A first Degree in Engineering of at least 120 credits (SLQF L6) with First or Second Class Honours or
- (b) A first Degree in Engineering of at least 120 credits (SLQF L6) with acceptable postgraduate qualifications or a minimum of one year's experience after obtaining the Degree, in a field related to the programme of study or
- (c) Such other qualification equivalent to a first Degree in Engineering of at least 120 credits (SLQF L6) as may be recommended by the Faculty Higher Degrees Committee as suitable for candidature for the MEng Degree with a minimum of one year's experience, after obtaining such qualification, in a field related to the programme of study.

3.3 Degree of Master of the Science of Engineering in Geotechnical Engineering (SLQF L10): *MScEng (Geotechnical Engineering)*

- (a) A first Degree in Engineering of at least 120 credits (SLQF L6) with First or Second Class Honours or
- (b) A first Degree in Engineering of at least 120 credits (SLQF L6) with acceptable postgraduate qualifications or a minimum of one year's experience after obtaining the Degree, in a field related to the programme of study or

- (c) Such other qualification equivalent to a first Degree in Engineering of at least 120 credits (SLQF L6) as may be recommended by the Faculty Higher Degrees Committee as suitable for candidature for the MScEng Degree with a minimum of one year's experience, after obtaining such qualification, in a field related to the programme of study.

4. COURSE REQUIREMENTS AND THE DURATIONS

4.1 Postgraduate Diploma in Geotechnical Engineering (SLQF L8): PGDip (Geotechnical Engineering)

4.1.1 Course requirements

In order to be eligible for the award of the Postgraduate Diploma, a student shall have satisfied the following requirements.

A total of 25 credits earned with at least 2.75 GPA from prescribed courses including an independent study of at least 3 credits.

4.1.2 Minimum and Maximum Duration

The duration of the PGDip programme shall be ten (10) months (minimum).

To be eligible for the award of the Postgraduate Diploma, a student shall fulfil all stipulated requirements within 2 years from the date of registration on a full-time basis (3 years on a part-time basis) or as decided otherwise by the Faculty Board on the recommendation of FHDC under special circumstances.

4.2 Degree of Master of Engineering in Geotechnical Engineering (SLQF L9): MEngGeotech

4.2.1 Course requirement

In order to be eligible for the award of the degree of Master of Engineering, a student shall have a total of 30 credits earned with at least 3.0 GPA from the prescribed courses including an advanced study of at least 5 credits.

4.2.2 Minimum and Maximum Duration

The duration of the prescribed programme shall be twelve (12) months (minimum).

In order to be eligible for the award of the degree of Master of Engineering, a student shall fulfil all stipulated requirements within 3 years from the date of registration on a full-time basis (4.5 years on a part-time basis) or as decided otherwise by the Faculty Board on the recommendation of FHDC under special circumstances.

4.3 Degree of Master of the Science of Engineering (SLQF L10): MScEng (Geotechnical Engineering)

4.3.1 Course requirement

In order to be eligible for the award of the Degree of Master of the Science of Engineering, a student shall have;

- (i) earned a total of 30 credits from the prescribed courses with at least 3.0 GPA and
- (ii) successfully completed a research study of 30 credits.

4.3.2 Minimum and Maximum Duration

The duration of the prescribed programme shall be 2 years (minimum).

In order to be eligible for the award of the Degree of Master of the Science of Engineering, a student shall fulfil all stipulated requirements within 4 years from the date of registration on a full-time basis (6 years on a part-time basis) or as decided otherwise by the Faculty Board on the recommendation of FHDC under special circumstances.

5. COURSE FEE

- Rs. 350,000.00 for Postgraduate Diploma (SLQF L8)
- Rs. 400,000.00 for Degree of Master of Engineering (SLQF L9)
- Rs. 475,000.00 for Degree of Master of the Science of Engineering (SLQF L10)

In addition to above fee a refundable library deposit of Rs. 10,000.00 and Standard Library Deposit of Rs. 4,000.00 should be paid at the time of the registration for the postgraduate programme.

6. APPLICATION PROCEDURE

Applications for enrolment must be submitted online through <https://pgciviladmissions.eng.pdn.ac.lk/login> on or before **22nd of November 2021**.

The following documents should be uploaded along with the duly completed application:

- a) Degree/Diploma/Professional membership certificates and Academic Transcript.
- b) Two Referee Reports (Online). At least one should be from the applicant's teacher at the University.
- c) Birth certificate and National Identity Card.
- d) Letter of consent on granting leave to engage in PG study from the employer (where applicable).
- e) Application processing fee - Proof of payment (deposit slip)
- f) Recent colour photograph (passport posture)

Originals of documents of which the image copies are uploaded should be produced before admission, on request. Also, applicant should arrange to send the official transcripts directly by the educational institutions concerned to the **Assistant Registrar, Faculty of Engineering, University of Peradeniya, Peradeniya**.

In the event of any discrepancy between the name appearing in the applicant's academic/professional/birth certificates and the name given by the applicant in the application, an affidavit to the effect that the applicant is the one and the same person known by all such names should be sent together with the application form.

A payment of Rs. 2,000.00 has to be done to the below account as the non-refundable application processing fee.

Bank : Bank of Ceylon
Branch : Peradeniya
Name of Account : Research and Fund Account
Account Number : 001274688

Documents submitted in support of an application shall become the property of the University. The applicants will be informed of their acceptance/non-acceptance to the particular programme for which admission has been sought.

Applications which are received late/or are incomplete in any respect are liable to be rejected. **Only shortlisted applicants will be called for an interview.**

The University may at its discretion refuse admission to any applicant.

For inquiries please contact the Coordinator of the Geotechnical Engineering programme, Dr. S.K. Navaratnarajah, Department of Civil Engineering, University of Peradeniya, Tel:0777346619, e-mail: navask@eng.pdn.ac.lk