GEOTECHNICAL Engineering Examination

Information for Applicants

professional engineers board Singapore
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Professional Engineers Specialist Registration Examination On Geotechnical Engineering

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1 INTRODUCTION

The Professional Engineers Act provides for the registration of specialist professional engineer. In particular, a professional engineer registered in the branch of civil engineering may apply to the Professional Engineers Board to be registered as a specialist professional engineer in geotechnical engineering.

To apply for registration, the applicant must have in force a valid practicing certificate. He must possess the requisite number of years of recognised practical experience, a certain number of which must be in geotechnical engineering. He is also required to have a post-graduate engineering degree (such as M.Sc or PhD) majoring in geotechnical engineering or **sat and passed a specialist registration examination on geotechnical engineering conducted by the Board.**

The specialist registration examination on geotechnical engineering conducted by the Board is an **oral examination**. The syllabus for the examination is specified in Annex A.

The following sections set out the requirements and syllabus for the specialist registration examination on geotechnical engineering while details on application can be found at Specialist PE Examination page of PE account at www.peb.gov.sg.

2 ELIGIBILITY TO SIT FOR EXAMINATION

A professional engineer registered in the branch of civil engineering may apply to sit for the specialist registration examination on geotechnical engineering conducted by the Board.

A stand down period of 24 months will be applicable before the next application for examination

3 FEES

The fees for an application to sit for the specialist registration examination on geotechnical engineering is $1,200.

4 APPLICATION FORM

Application and payment shall be made online at PE account with PEB's website. All required documents are to be submitted to PEB within a week after application is made online. Application form submitted more than two months after the date of online submission will not be accepted. Applicants would be informed of the status of their applications and other details by post at least two weeks before the examinations.

5 RESULT NOTIFICATION

Result of the oral examination will be given to candidates on a Pass/Fail basis.

Annex A

SYLLABUS FOR SPECIALIST REGISTRATION EXAMINATION IN GEOTECHNICAL ENGINEERING

Geology of Singapore

- Basic geological formations of Singapore and their distribution
- Weathering classification and description of rocks for engineering purposes
- Classification of recent deposits and their characteristic soil properties

Soil Mechanics Fundamentals

- Index properties
- Soil classification
- Mechanical properties - shear strength, compressibility and permeability
- Concepts of effective stress versus total stress
- Soil compaction
- Bearing capacity of soil
- Seepage and ground water flow
- Settlement and consolidation
- Stress distribution

Rock Mechanics Fundamentals

- Intact rock properties, Influence of sample size
- Factors defining the behavior of rock mass versus intact rock; types of discontinuities
- Rock tests: unconfined compression test, point load test, durability test
- Rock mass properties; Mohr-Coulomb parameters; Hoek and Brown empirical failure criteria, deformation modulus
- Shear strength of discontinuities
- Rock mass classification, RMR and Q
- Cross-section shapes of underground excavations in rock
- Typical failure mechanisms in rock excavations and post-failure behavior
- Design of rock support
- Interaction of rock support with deformation behavior of rock mass

Site Investigation

- Types of drilling (rotary drilling, wash boring, flight auger, etc.)
- Types of in-situ testing including standard penetration test (SPT), vane shear test (FVT), cone penetration test (CPT), pressuremeter test (PMP), permeability test, Packer test
- Types of sampling method such as Shelby tube, open drive sampler, piston sampler, Mazier sampler, diamond coring for rocks, etc.

- Ground water hydrology, such as the source of ground water or pore- pressure which may affect the geotechnical design
- Significance of soil sample and rock core recovery rate and RQD
- Planning requirements such as number of borehole and their locations, depth of drilling, types and frequencies of sampling and in-situ testing and types of laboratory tests, etc.
- Significance of desk top study such as knowing the geological formation and topography, searching for available data from various sources on soil conditions, knowing the presence and types of surrounding structures, etc.
- Significance of site reconnaissance before drilling and visits during drilling to understand the site conditions, observing the performance of surrounding structures and checking the progress and quality of drilling works, etc.

Field and Laboratory Testing

- Principles of various in-situ tests (SPT, FVT, CPT, PMT, permeability test and Packer test) and the interpretation of test results, sources of errors and the range of applications in geotechnical design
- Principles of common laboratory tests to obtain index properties, shear strength and modulus (drained and undrained with or without pore-water measurements), consolidation test, permeability test, uni-axial compression test on rock, point load test on rock, etc.; interpretation of test results and their range of applications

Soil Properties

- Physical properties and their inter-relationships and significance in geotechnical design
- Mechanical properties such as strength (drained and undrained), compressibility and permeability
- Chemical properties which may affect the design of foundation

Constitutive Soil Models

- Understand limitations and range of applications of Mohr-Coulomb model and other advanced soil models
- Understand the significance of each soil parameter
- Know how to evaluate soil parameters for each soil model
- Understand the significance of total and effective stress analysis as well as undrained, drained and consolidation analysis

Instrumentation

- Types of geotechnical instruments and their engineering purposes
- Principles of each instrument, method of installation, potential sources of errors in installation and measurement
- Planning of instrumentation program (location and depth of installation, monitoring frequency, review levels, etc.)
- Interpretation of readings and their implications; potential sources of errors

Foundation Engineering

- Shallow foundations – footings and rafts
- Deep foundations – driven piles, bored piles and caissons
- Chin's method and Hiley formula
- Wave equation analysis - PIT, PDA and CAPWAP
- Pile load tests and interpretation of results
- Group piles; capacity and settlement
- Lateral loads on piles
- Underpinning

Earth Retaining Structures

- Earth pressure on walls (Rankine, Coulomb and log-spiral method)
- RC retaining wall
- Gravity retaining wall – crib wall, reinforced soil, gabion wall
- Embedded retaining wall – cantilever, propped and anchored
- Seepage and pore pressure considerations

Tunneling

- Excavation methods in soil and rock
- Ground support methods in soil (temporary & permanent)
- Rock support methods (temporary & permanent)
- Excavation sequencing
- Staging of rock support application
- Maintaining stability of the excavation face
- Dealing with groundwater during excavation
- Rock mass improvement

Slope Stability

- Taylor's chart, Infinite slope, Swedish method and various approaches utilizing the method of slices, circular and non-circular slip analysis
- Effect of soil suction on slope stability
- Total and effective stress analysis as well as drained and undrained analysis, cut slopes and embankment slopes
- Evaluation of soil strength and ground water regime
- Preventive works and remedial measures

Soil Improvement

- Surface compaction
- Pre-loading and surcharging
- Prefabricated vertical drains, sand drains
- Stone columns
- Dynamic and vibro compaction
- Deep mixing and jet grouting
- Chemical grouting
- De-watering
- Seepage cut-offs
- Soil reinforcement – geosynthetics, soil nails

Ground Anchors

- Element of ground anchors
- Load deriving zones
- Fixed length design
- Load and creep tests
- Pre-loading of anchors
- Corrosion protection