IES Academy

GEOTECHNICAL ENGINEERING APPRECIATION COURSE

(also useful for PEs who intend to sit for PE(Geo) Exam)

Jointly organized by Geotechnical Society of Singapore and Institution of Engineers Civil and Structural Engineering Technical Committee

PROGRAMME DETAILS

Date	: 27 July 2009 - 31 August 2009
Duration	: 15 evenings (9 modules)
Time	: 6.30PM - 9.30PM
Venue	: 90 Stamford Road, Singapore 178903 (5 min walk from Dhoby Ghaut MRT)
PDU Units	: To Be Confirmed
Organizers	: IES & GeoSS
Fees	: $98 for 3 hours module / $180 for 6 hours module (IES & GeoSS Members) $118 for 3 hours module / $200 for 6 hours module (Non-Members)

Discounts up to $150, for attending multiple modules

** Fees inclusive of 7% GST, course materials and light refreshments.*

** Certificate of Attendance for modules attended will be issued to participants with at least 75% attendance.*

In Singapore, infrastructural and building development works are often carried out in close proximity to one another. As a result, civil engineers have to tackle many challenging geotechnical problems in these works. In view of the above, the Professional Engineers Geotechnical Specialist [PE(Geo)] Registration has recently been introduced. For civil engineers who do not have a higher degree in geotechnical engineering, they must sit for the PE(Geo) Examination before applying for the specialist registration. This highlights the importance of appreciation of various geotechnical engineering topics by PE(Geo). The Geotechnical Society of Singapore (GeoSS) and the Institution of Engineers (IES) Civil and Structural Engineering Technical Committee had jointly embarked the Geotechnical Engineering Appreciation Course which comprises modules of various geotechnical topics that closely resemble the syllabus of the PE(Geo) examination. The course, which is structured into modular form for engineers to pick and choose, will be taught by geotechnical experts from the universities and the practices.

[Note: Unfortunately tunneling will not be covered in this course due to non-availability of module lecturer.]
Course participants:

1. Civil engineers who wish to enhance their know-how and appreciation on various geotechnical engineering topics.
2. Civil engineers who will sit or have intention to sit for the PE(Geo) examination.

Module Schedule (evenings 6.30pm - 9.30pm)

Module	Module Course Fees (Inclusive of GST)	Dates	Lecturers
1 (6 hrs)	**$180 (M), $200 (NM)**	**Monday 27 July Wednesday 29 July**	**Dr S H Chew**
2 (6 hrs)	**$180 (M), $200 (NM)**	**Friday 31 July Monday 3 Aug**	**A/Prof J Chu**
3 (3 hrs)	**$98 (M), $118 (NM)**	**Wednesday 5 Aug**	**Dr Y X Zhou & Dr J G Cai**
4 (3 hrs)	**$98 (M), $118 (NM)**	**Friday 7 Aug**	**Dr I H Wong**
5 (6 hrs)	**$180 (M), $200 (NM)**	**Wednesday 12 Aug Friday 14 Aug**	**Dr S H Goh**
6 (6 hrs)	**$180 (M), $200 (NM)**	**Monday 17 Aug Wednesday 19 Aug**	**A/Prof A T C Goh**
7 (6 hrs)	**$180 (M), $200 (NM)**	**Friday 21 Aug Monday 24 Aug**	**A/Prof B K Low**
8 (6 hrs)	**$180 (M), $200 (NM)**	**Wednesday 26 Aug Friday 28 Aug**	**Dr Indrayogan**
9 (3 hrs)	**$98 (M), $118 (NM)**	**Monday 31 Aug**	**Dr C K Loh**

2 modules -- discount $10
3 modules -- discount $20
4 modules -- discount $30
5 modules -- discount $50
6 modules -- discount $70
7 modules -- discount $90
8 modules -- discount $120
all 9 modules -- discount $150

Term and condition:
The discount only applies when participants register the modules in one go.

As an example, if an IES / GeoSS member applies for all the 9 modules, the course fees payable:
$180 x 6 + $98 x 3 - **$150 discount** = $1,224 (Inclusive of GST)

Module 1: Site Investigation and Insitu Tests (6 hrs by Dr S H Chew, NUS)

- Types of drilling (rotary drilling, wash boring, flight auger, etc)
- Types of sampling method such as Shelby tube, open drive sampler, piston sampler, Mazier sampler, diamond coring for rocks, 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
- 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
- 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.

Module 2: Soil Mechanics and Soil Models (6 hrs by A/Prof J Chu, NTU)

- Soil Mechanics Fundamentals
  - Index properties
  - Soil classification
  - Concepts of effective stress versus total stress
  - Soil compaction
  - Seepage and ground water flow

- Laboratory testing and Soil Properties
  - Compressibility of soil and laboratory tests to measure the compressibility of soil
  - Consolidation behaviour of soil and laboratory tests to measure the consolidation properties of soil
  - Shear strength behaviour of soil and laboratory tests to measure the shear strength of soil
  - Stress-strain behavior of soil and laboratory tests to measure the stiffness of soil
  - Correlations between the mechanical properties of soil and the physical properties

- Constitutive Soil Models
  - Different types of constitutive models and their limitation
  - The meaning of total and effective stress analysis as well as undrained, drained and consolidation analysis.
  - Soil parameters required for different types of constitutive models
  - Use of the Mohr-Coulomb model and its limitations
  - Determination of soil parameters for Mohr-Coulomb model
  - Use of the Modified Cam Clay model and its limitations
  - Determination of soil parameters for the Modified Cam Clay model

<u>Module 3</u>: Geology and Rock Mechanics Fundamentals (3 hrs by Dr Y X Zhou, DSTA)

- 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

- 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

<u>Module 4</u>: Shallow foundation (3 hrs by Dr I H Wong, Mitic Associates)

- Bearing capacity of soil
- Stress distribution
- Settlement and consolidation
- Shallow foundations – footings and rafts

<u>Module 5</u>: Deep foundation (6 hrs by Dr S H Goh, NUS)

- Deep Foundations
  - 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

<u>Module 6</u>: Retaining structures and deep excavation (6 hrs by A/Prof A T C Goh, NTU)

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

Module 7: Slope stability (6 hrs by A/Prof B K Low, NTU)

- 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

Module 8: Soil improvement and ground anchors (6 hrs by Dr Indrayogan, GeoEng Consultants)

- Soil Improvement
  - Surface compaction
  - Pre-loading and surcharging
  - Pre-fabricated vertical drains, sand drains
  - Stone columns
  - Dynamic and vibro compaction
  - Deep mixing and jet grouting
  - Chemical grouting
  - De-watering
  - Seepage cut-offs
  - Soil reinforcement – reinforced soils, 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

Module 9: Instrumentation (3 hrs by Dr C K Loh, Tritech Consultants)

- 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

Lecturers

Dr J G Cai

Dr Cai Jun Gang is currently an Executive Director of Tritech Consultants Pte Ltd. He was involved in most underground rock cavern projects in Singapore, such as rock cavern development in the Jurong Formation, underground ammunition facilities, underground science city at Kent Ridge, and oil storage rock caverns at Jurong Island. He has 20 years of experience in rock engineering R&D and consultancy. Dr Cai holds a BEng and MEng in Engineering Geology from Southwest Jiaotong University of China, and a MEng and PhD in Geotechnical Engineering from the Nanyang Technological University of Singapore.

Dr S H Chew

Dr Chew Soon Hoe is the Deputy Director of the Centre for Protective Technology and an Assistant Professor of National University of Singapore. He obtained his BEng from NUS and Ph D from University of California Berkeley, USA. He is actively involved in research and consultancy in geosynthetics, erosion control, ground improvement and deep excavations and published widely in his research areas. He is PE of Singapore and President of Southeast Asia Chapter of International Geosynthetics Society.

A/Prof J Chu

Dr Chu Jian is an Associate Professor in the School of Civil and Environmental Engineering, Nanyang Technological University. He received his Ph.D. from University of New South Wales, Australia. His research interest includes soil properties and ground improvement. He is the Chairman of ISSMGE Technical Committee TC39 and the Coordinator of Working Group C of ISSMGE TC17. He has published widely and delivered keynote/invited lectures at several major international conferences. He received the R.M. Quigley Award for publishing the best paper in the Canadian Geotechnical Journal in 2003.

Dr S H Goh

Dr Goh Siang Huat is an Assistant Professor in the Civil Engineering Department, National University of Singapore. He obtained his B.Eng and M.Eng from NUS, and Ph.D from Cornell University, USA. He has also worked in the geotechnical consulting practice for several years in New York City. His current teaching and research interests cover various aspects of seismic soil-structure interaction, such as the numerical and experimental modeling of piles subjected to earthquake loadings.

A/Prof A T C Goh

Dr Anthony Goh is an Associate Professor in the School of Civil and Environmental Engineering, Nanyang Technological University. He received his B.Eng. (1^{st} class Honours) and Ph.D. from Monash University, Australia. His teaching, research and professional practice have covered many aspects of geotechnical engineering including finite element analysis, earth retaining structures, pile foundations, reliability analysis and soil liquefaction.

Dr Indrayogan

Dr Indrayogan Yogarajah obtained his Beng (1^{st} class Honours) and Ph D from University of Strathclyde, UK. He also has LLB (Hons) degree from University of London and a MBA from the Helsinki School of Economics and Business Administration. He is PE(Geo) and AC(Geo) of Singapore. After working many years in geotechnical practice in Southeast Asia, he founded the GeoEng Consultants which is one of the largest geotechnical specialist consultancy firms in Singapore.

Dr C K Loh

Dr. Loh Chang Kaan is a Director of Tritech Engineering & Testing (Singapore) Pte Ltd and other subsidiaries of Tritech Group Limited since 2000. He has more than 15 years of experience in geotechnical projects, especially in instrumentation monitoring works. Projects involved include; LTA's MRT Circle Lines, Downtown Lines, PUB DTSS tunnels, HDB slopes, DSTA slope as well as private developers' deep basement excavation works. Dr Loh has conducted various seminars and training courses on geotechnical instrumentation for BCA Academy, IES and other organizations. Dr Loh holds a MEng and PhD from the National University of Singapore. He is a registered Specialist Professional Engineer (Geotechnical) in Singapore, and a registered Professional Engineer in Malaysia.

A/Prof B K Low

Dr Low Bak Kong obtained his BS and MS degrees from MIT, and PhD degree from U.C. Berkeley. He is a Fellow of ASCE, and a registered PE of Malaysia. He is an associate professor at the Nanyang Technological University. Apart from his long teaching and research career at NTU, Prof Low also conducted research while on sabbatical leaves at HKUST (Sept-Dec 1996), University of Texas at Austin (Jan-April 1997) and Norwegian Geotechnical Institute (May-August 2006).

Dr I H Wong

Dr Ing H. Wong is a principal consultant with Mitic Associates. He obtained his BSc (1st Honours) in Civil Engineering from Imperial College, and his MEng and Ph D from the Massachusetts Institute of Technology. He is a PE(Geo) of Singapore. He was with Ebasco Services Inc in New York and Dames and Moore in New Jersey, and also an Adjunct Professor at Columbia University and Polytechnic University. Dr Wong was also on the academic staff at the former University of Singapore and at Nanyang Technological University. In 2000, Dr Wong received the Thomas A Middlebrooks Award from ASCE.

Dr Y X Zhou

Dr Zhou Yingxin is Senior Principal Engineer and Programme Manager for Underground Technology & Rock Engineering with the Defence Science & Technology Agency (DSTA). Since joining DSTA in 1994, Dr Zhou has extensive experience in underground rock caverns. He is currently President of the Society for Rock Mechanics & Engineering Geology Singapore and President of the ISRM Commission on Rock Dynamics. He is currently Congress Co-chair of the ISRM 2011 International Congress on Rock Mechanics in Beijing China and a member of the Editorial Board for the International Journal of Tunnelling & Underground Space Technology.

REGISTRATION FORM

Geotechnical Engineering Appreciation Course

Date : 27 July 2009 - 31 August 2009
Time : 6.30pm - 9.30pm
Venue : 90 Stamford Road
Singapore 178903
Fees : $98 for 3 hours module / $180 for 6 hours module (IES & GeoSS Members)
$118 for 3 hours module / $200 for 6 hours module (Non-Members)

Please tick (√) the module(s) you are interested in: 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □

Please note that online registration is only available for signing up all 9 modules.
Otherwise, please mail/fax the completed form **by 17 July 2009 before 3pm** to:

Address: IES Academy
70 Bukit Tinggi Road
IES Building
Singapore 289758
(Tel) 6463 9211 (Fax) 6463 9468

Participant Details

Name : _____ NRIC : _____

Company : _____ Designation: _____

Address : _____

Postal Code : _____ Sex : Male / Female

Tel / Mobile : _____ Fax : _____

Email : _____

Please indicate : ❑ IES Members IES M'ship No.: _____ P.E. No.: _____ (if applicable)
❑ GeoSS Members GeoSS M'ship No.: _____
❑ Non-Members ❑ Sponsored by Company

Date : _____ Signature : _____

Contact Person Details *(if different from participant)*

Name : _____ Designation: _____
Tel / Mobile : _____ Fax : _____
Email : _____

Payment Details

Bank / Cheque No.: _____ Amount ($) : _____

* All Fees are inclusive of 7 % GST.
Cheque should be made payable to: "Institution of Engineers, Singapore" or "IES".

Acceptance of Terms and Conditions for Registration of IES Academy's Events

I agree to abide by the Terms and Conditions for Registration of IES Academy's Events.

Name : _____ Signature : _____

TERMS & CONDITIONS FOR EVENT REGISTRATION

Registration

Any registration, whether on-line or fax will be on a ***first-come-first-served basis*** and will only be confirmed upon receipt of full payment by The Institution of Engineers, Singapore (IES) unless otherwise invoice to company.

All registrations must be submitted with duly completed registration form.

Email registrations will not be accepted.

Closing Date & Payment

The closing date of the event will be 5 working days prior to event commencement date. Cheques should be crossed 'A/C payee only' and made payable to '**Institution of Engineers, Singapore' or 'IES'**, with the ***Title of the Event indicated clearly written on the back of the cheques*****,** and submitted with the duly completed registration forms to:

IES Academy
70 Bukit Tinggi Road
Singapore 289758

Confirmation of Registration

Confirmation of registration will be given 5 working days prior to the commencement date via email, and you are required to acknowledge it. If you do not receive the said confirmation email, you are required to contact IESA general admin immediately at 6463 9211 (office).

IESA reserves the right to allow only confirmed registrants to attend the Event.

Withdrawals/Refunds of Fees

Notice of withdrawal must be given in writing to IESA. Policy on refund of the event fee is as follows:

- **FULL** refund if we receive your written notice of withdrawal at least **3** working days before the commencement of the Event.
- **NO** refund otherwise.

No show of participant would not be accepted as reason for withdrawal/refund.

Replacement is allowed but restrict to once only. However, when a member is replaced by a non-member, the participant has to pay the difference in the relevant fees applicable before the commencement date.

Cancellation/Postponement

Changes in Venue, Dates, Time and Speakers for the Events can occur due to unforeseen circumstances. IES reserves the full rights to cancel or postpone the Event under such circumstances without prior reasons. Every effort, however, will be made to inform the participants or contact person of any cancellation or postponement.

Fees will be refunded in FULL if any Event is cancelled by IESA.

Enquiries

For further enquiries, please contact Jasmine at 6461 1238 or IESA general office at Tel: 6463 9211.