ES4D8-15 Advanced Geotechnical Engineering

21/22

Department
School of Engineering
Level
Undergraduate Level 4
Module leader
Gary Fowmes
Credit value
15
Module duration
19 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES4D8-15 Advanced Geotechnical Engineering

Module web page

Module aims

To deepen knowledge and understanding across advanced topics in geotechnical engineering. To instil an appreciation of the principles, theories and concepts related to Tunnelling and Underground Space, Legislation & Planning about Contaminated Ground, Risk assessment for Contaminated Land and Groundwater, Ground improvement techniques.
The students will be given the opportunity in the field work to carry out practical activities related to geological controls on instability.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Problem Ground Improvement techniques: Overview of problem ground conditions, giving details and case studies on the following: Shrinking and swelling clays, peat and glacial tills. The students are introduced to difficult sites through problem based learning using real world data and drawings.
Ground improvement techniques covered include replacement, dynamic and vibro compaction, use of admixtures and the use of geosynthetic. Geosynthetics reinforced soil is demonstrated in a laboratory wall building session.

Introduction to Tunnelling: Methods of tunnelling and support. Design using rock classification systems such as Q and RMR. Prediction of subsidence. Modelling of discontinuity defined failures in roof and walls of underground excavations. Practical laboratory demonstrations of rock bolting will also be given.

Contaminated Ground: Concepts. Legislation & planning advice in the UK. Risk assessment for contaminated land and groundwater: Source-pathway-target framework.
Site & ground investigation and sampling/analysis, conceptual modelling, risk detection.
Characteristics and sources of contaminated land and groundwater pollution, pollutant properties.
Porous media transport, diffusion and dispersion and reactions. Governing equations including sources and sinks, adsorption and desorption. Mathematical models and concepts including retardation coefficients and the effect of organic matter, analytical and numerical
Modelling approaches. Covering systems, pump & treat technology, in-situ air-sparging.

Field Course (3 days): To the Isle of Wight, to inspect and map examples of land instability in the Ventnor Undercliff area (the largest urban landslide complex in Europe) and elsewhere. Geological controls on instability. Assessment of hazard and risk.

Learning outcomes

By the end of the module, students should be able to:

- Demonstrate advanced understanding of how to manage ground engineering problems
- Apply and evaluate the techniques currently available for ground improvement and specify techniques for different site conditions.
- Critically evaluate design methods for the treatment and containment of waste and the types of problems which may arise in the development of difficult, derelict and contaminated land.
- Synthesise geotechnical and other data and apply it to the design of underground openings.

Indicative reading list

Ratan,T. Civil excavations and tunnelling– a practical guide, 2005.
Hemphill, G.B., Practical tunnel construction, 2012.
Maidl, B., Schmid, L., Ritz, W., Herrenknecht, M., Sturge, D.S., Hardrock Tunnel Boring Machnies, 2008.
Nathanail, P.C. Reclamation Of Contaminated Land, 2004.
Todd D.K., and Mays L.W., Groundwater hydrology, 2008.
Zheng C. and Bennett G.D, Applied Contaminant Transport Modeling, 2002.
Ward A.D., Trimble S.W., Burckhard S.R., Lyon J.G., Environmental Hydrology, 2015.

Subject specific skills

Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints .
Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations.

Transferable skills

Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate

---

Study

Study time

Type	Required
Lectures	19 sessions of 1 hour (13%)
Tutorials	2 sessions of 2 hours (3%)
Practical classes	2 sessions of 2 hours (3%)
Fieldwork	3 sessions of 8 hours (16%)
Other activity	3 hours (2%)
Private study	96 hours (64%)
Total	150 hours

Private study description

96 hours of guided independent learning

Other activity description

3 x1h revision classes

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group A1

Assessment component	Weighting	Study time	Eligible for self-certification
ASSIGNMENT	100%		No

Reassessment component is the same

Feedback on assessment

Cohort level feedback on the written sprint coursework.

Availability

Pre-requisites

To take this module, you must have passed:

- All of
  - ES3B6-30 Geotechnical Engineering

Courses

This module is Core for:

- Year 4 of UESA-H217 MEng Civil Engineering
- Year 4 of UESA-H219 MEng Civil Engineering with Exchange Year
- Year 5 of UESA-H218 MEng Civil Engineering with Intercalated Year

This module is Option list A for:

- Year 4 of UESA-H114 MEng Engineering
- Year 4 of UESA-H311 MEng Mechanical Engineering