Engineering Tripos Part IIB, 4D14: Contaminated Land & Waste Containment, 2019-20

Module Leader

Prof A Al-Tabbaa [1]

Lecturers

Prof A Al-Tabbaa and Prof G Madabhushi [2]

Lab Leader

Prof A Al-Tabbaa [1]

Timing and Structure

Michaelmas term. 14 lectures + 1 examples classes + 1 invited lecture + coursework. Assessment: 75% exam/25% coursework.

Aims

The aims of the course are to:

- provide an in-depth look at aspects of contaminated land and waste containment including sources of contamination, characterisation of waste, assessment, containment, remediation and sustainable regeneration.

Objectives

As specific objectives, by the end of the course students should be able to:

- develop an appreciation of current and future problems and legislations related to contaminated land and waste containment;
- develop good understand of contaminated land remediation options and selection decisions.
- develop an understanding of decision support tools for contaminated land management.
- identify potentially hazardous chemicals and sources of contamination.
- appreciate the crucial stages in dealing with and managing contaminated land.
- assess the risk of pollution hazards from buried wastes.
- appreciate the legal, technical and health constraints on the design of waste repositories.
- discuss the design of appropriate containment facilities.

Content

The module starts with an overview of contaminated land and waste containment and a review of contaminants in the ground and methods of groundwater analysis. This is followed by l ectures on disposal of waste in the ground to develop an understanding of the safe design of landfill sites for disposal of waste materials. Finally the module looks at contaminated land remendiation, management and aspects of sustainable regeneration

Introduction to contaminated land and waste containment (1L, Prof A Al-Tabbaa)

- Introduction and overview of contaminated land remediation and waste and its containment;
- Introduction to relevant legislation

Disposal of waste in the ground (5L, Prof G Madabhushi; 1 example class)

- Characterisation of waste materials;
- Estimation of landfill size, cost of waste disposal, Landfill Tax
- Design of barriers: grout curtain, slurry wall, geomembranes;
- Constructed facilities: design of landfill and hazardous waste repositories

Contaminants and analysis in soil and water (2L, Dr R J Lynch)

- Contamination in the environment, introduction of inorganic and organic contaminants, and their analysis;
- Demonstration of pollutant analysis in soils and water

Contaminated land remediation and regeneration (6L, Prof A Al-Tabbaa, 1L Guest Speaker)

- Land contamination and remediation, sources and solutions including case studies;
- Sustainable remediation of contaminated land;
- Decision support tools including cost-benefit analysis, life cycle assessment and multi-criteria analysis;
- Sustainable brownfield land management and regeneration

Coursework

Cost-benefit analysis of remediation techniques at a contaminated site.

Coursework	Format	Due date & marks
Qualitative appraisal for the remediation of a contaminated site The coursework will involve carrying a qualitative appraisal, using the Environment Agency 'Cost-benefit analysis for remediation of land contamination' document, comparing six remediation techniques on a real contaminated site. Extracts from the site investigation report will be provided and the site is to be redeveloped for industrial use. Learning objectives: • Develop a good understand of contaminated land remediation selection decisions • Develop an appreciation of the factors influencing such decisions • Develop an appreciation of impact of sensitivity analyses on the decision outcome • Develop a good practice for writing a professional report	Individual Report anonymously marked	by noon on Friday 6 D [15/60]

Booklists

Please see the Booklist for Group D Courses [3] for references for this module.

Examination Guidelines

Please refer to Form & conduct of the examinations [4].

UK-SPEC

This syllabus contributes to the following areas of the UK-SPEC [5] standard:

Toggle display of UK-SPEC areas.

GT1

Develop transferable skills that will be of value in a wide range of situations. These are exemplified by the Qualifications and Curriculum Authority Higher Level Key Skills and include problem solving, communication, and working with others, as well as the effective use of general IT facilities and information retrieval skills. They also include planning self-learning and improving performance, as the foundation for lifelong learning/CPD.

IA1

Apply appropriate quantitative science and engineering tools to the analysis of problems.

IA2

Demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs.

KU1

Demonstrate knowledge and understanding of essential facts, concepts, theories and principles of their engineering discipline, and its underpinning science and mathematics.

KU2

Have an appreciation of the wider multidisciplinary engineering context and its underlying principles.

D1

Wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations.

D3

Identify and manage cost drivers.

D6

Manage the design process and evaluate outcomes.

S1

The ability to make general evaluations of commercial risks through some understanding of the basis of such risks.

S3

Understanding of the requirement for engineering activities to promote sustainable development.

S4

Awareness of the framework of relevant legal requirements governing engineering activities, including personnel,

health, safety, and risk (including environmental risk) issues.

E1

Ability to use fundamental knowledge to investigate new and emerging technologies.

E2

Ability to extract data pertinent to an unfamiliar problem, and apply its solution using computer based engineering tools when appropriate.

E3

Ability to apply mathematical and computer based models for solving problems in engineering, and the ability to assess the limitations of particular cases.

P1

A thorough understanding of current practice and its limitations and some appreciation of likely new developments.

P3

Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology, development, etc).

US1

A comprehensive understanding of the scientific principles of own specialisation and related disciplines.

US4

An awareness of developing technologies related to own specialisation.

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Links
[1] mailto:aa22@cam.ac.uk
[2] mailto:aa22@cam.ac.uk, mspg1@cam.ac.uk
[3] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=52241
[4] https://teaching.eng.cam.ac.uk/content/form-conduct-examinations
[5] https://teaching.eng.cam.ac.uk/content/uk-spec