Engineering Tripos Part IIB, 4M9: Surveying Field Course, 2017-18

Module Leader

Mr A L Johnson [1]

Timing and Structure

Long Vacation between Part IIA and Part IIB. 2 - 15 July 2017 for 2017/18. and 1 - 14 July for 2018/19
-Assessment: 100% coursework

Prerequisites

Surveying experience, e.g. from IIA Engineering Area Activity or Fieldwork project.

Aims

The aims of the course are to:

- give students experience in surveying to a high accuracy, on a larger scale (and at greater altitude) than is possible near Cambridge.

Objectives

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

- plan the work for a complex setting-out exercise.
- know how to use high-accuracy and long-range surveying equipment.
- understand the role of GNSS in modern survey.
- know the calculation methods needed for the reduction of three-dimensional survey data.
- have experience in leading a survey team, and the planning of logistics.
- understand the effects of small errors in measurement, and how to minimise their effects.
- understand the need for long-term record keeping, and the information to be recorded.

Content

This module gives students experience in surveying to a high accuracy, on a larger scale than is possible near Cambridge. The exercise includes three-dimensional position-fixing and setting-out in a hilly location, and involves the use of first-order surveying instruments and precise computation.

Throughout the course, short lectures will be given as necessary to explain the theory needed for the practical work in hand. Topics covered include: geoids, ellipsoids, projections and grids; the theory and practice of GNSS, including the verification of Geoid models; reduction of angles and distances; least-squares adjustment.

The course has a capacity of 16. If over-subscribed, a ballot will be held in May, but with preference given to Civil Engineering students.

Coursework

The Course runs continuously over a two week period, and includes the following:

- Exercise planning and siting of control stations;
- Fixing of control stations using GNSS;
- High-accuracy traversing and resectioning;
- Fixing of heights by precise digital levelling and trigonometric heighting;
- Long-range distance measurement;
- Three-dimensional setting out;
- Adjustment, computation and record keeping.

The output of this course will be a set of numerical calculations leading to the setting-out of one or more points in the field. Since incorrect answers will be systematically eliminated from this result, assessment will be based on the course demonstrators' estimation of each student's ability to:

- Take accurate readings efficiently with the equipment provided;
- Make a neat and decipherable record of other students' readings;
- Produce accurate and well laid-out calculations;
- Check the calculations of others;
- Plan and manage the activities of the team;
- Generally contribute to the efficiency and productivity of the team.

Booklists

References for this module. [2]

Examination Guidelines

Please refer to Form & conduct of the examinations [3].

UK-SPEC

This syllabus contributes to the following areas of the UK-SPEC [4] 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.

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).

P7

Awareness of quality issues.

P8

Ability to apply engineering techniques taking account of a range of commercial and industrial constraints.

US1

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

US2

A comprehensive knowledge and understanding of mathematical and computer models relevant to the engineering discipline, and an appreciation of their limitations.

US3

An understanding of concepts from a range of areas including some outside engineering, and the ability to apply them effectively in engineering projects.

US4

An awareness of developing technologies related to own specialisation.

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Links
[1] mailto:alj3@cam.ac.uk
[2] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=56221
[3] https://teaching24-25.eng.cam.ac.uk/content/form-conduct-examinations
[4] https://teaching24-25.eng.cam.ac.uk/content/uk-spec