Engineering Tripos Part IIB, 4C4: Design Methods (shared with IIA), 2019-20

Leader

Dr J.M. Cullen [1]

Lecturers

Dr J.M. Cullen, Prof P.O. Kristensson [2]

Timing and Structure

Shared with IIA. Michaelmas term. 14 lectures + 2 examples classes. Assessment: 100% exam

Aims

The aims of the course are to:

- present useful tools for designers of all disciplines and illustrate the practical application of systems engineering and risk management techniques.

Objectives

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

- formulate a design problem, allowing the widest range of valid solutions.
- evaluate competing design concepts systematically.
- use techniques such as quality function deployment, and various creative methods.
- search for ways in which a design can fail, and assess likelihood of failure.
- appreciate how basic evaluation techniques can be applied to a complex design.
- appreciate how decisions regarding product architecture influence performance.

Content

Design Tools (8L)

Introduction to the design process; problem formulation; methods of searching for solutions; techniques for design evaluation; guidelines for embodiment design.

Systems Engineering (3L)

Introduction to systems engineering; system decomposition, integration and evaluation; Dependency Structure Matrices.

Risk Management (5L)

Introduction to risk management; rework; risk analysis; probabilistic design.

Booklists

Please see the **Booklist for Group C 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.

D4

Ability to generate an innovative design for products, systems, components or processes to fulfil new needs.

D6

Manage the design process and evaluate outcomes.

E1

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

E3

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

P3

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

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.

US3

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

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Links
[1] mailto:jmc99@cam.ac.uk
[2] mailto:pok21
[3] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=51681
[4] https://teaching21-22.eng.cam.ac.uk/content/form-conduct-examinations
[5] https://teaching21-22.eng.cam.ac.uk/content/uk-spec