Engineering Tripos Part IIB, 4C5: Design Case Studies, 2020-21

Module Leader

Dr N Crilly [1]

Lecturers

Prof J Clarkson and Dr N Crilly [2]

Lab Leader

Dr N Crilly

Timing and Structure

Lent term. 16 lecture slots, including lectures, group discussion and time for coursework. Assessment: 100% coursework

Aims

The aims of the course are to:

- illustrate the multi-disciplinary nature of engineering design
- illustrate the relationship between requirements, functions and solutions
- illustrate the importance of considering risk, error and safety
- illustrate the importance of understanding users and the contexts they operate in
- illustrate how to design for users' needs and preferences
- achieve the above through case studies of industrial systems and consumer products.

Objectives

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

- analyse and develop functional requirements for multi-disciplinary systems
- identify solution principles and components from catalogues, and combine them to fulfil system requirements
- identify and analyse risks associated with the development and delivery of multi-disciplinary systems
- research, analyse and describe the needs of users in specific product usage scenarios
- analyse, develop and justify decisions about product form and function in relation to user requirements and branding constraints
- analyse, develop and justify decisions about product form and function in relation to principles of physical and cognitive ergonomics.

Content

The course will be based on two case studies. Each case study will occupy eight lectures slots with the last one or two in each case study being used for coursework.

Topics to be covered within individual case studies include: multi-disciplinary systems design; component selection;

risk analysis; product testing; design for manufacture and assembly; user research; aesthetics; ergonomics; branding. Notes will be handed out summarising the main points covered in each case study.

Coursework

There will be a coursework exercise linked to each of the case studies with multi-part written assignments, using computer software where appropriate.

Coursework	Format	Due date & marks
Industrial System The purpose of this case study is to expose students to the complete design process for an inhaler test machine. Learning objectives: After completing this coursework, students should be able to • analyse and develop functional requirements for multi-disciplinary systems • identify solution principles and components from catalogues, and combine them to fulfil system requirements • identify and analyse risks associated with the development and delivery of multi-disciplinary systems.	Two individual reports. Anonymously marked	Approximatel (exact date T [30/60]
Consumer Product The purpose of this case study is to expose students to a research and development process for a design concept focussed on recreational use (sports, hobbies and pastimes). Learning objectives: After completing this coursework, students should be able to • research, analyse and describe the needs of users in specific product usage scenarios • analyse, develop and justify decisions about product form and function in relation to user preferences and branding constraints • analyse, develop and justify decisions about product form and function in relation to principles of physical and cognitive ergonomics.	One individual report. Anonymously marked	Approximatel date TBD) [30/60]

Booklists

Please refer to the Booklist for Part IIB Courses for references to this module, this can be found on the associated Moodle course.

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.

D1

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

D2

Understand customer and user needs and the importance of considerations such as aesthetics.

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.

E4

Understanding of and ability to apply a systems approach to engineering problems.

P3

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

P4

Understanding use of technical literature and other information sources.

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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