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# Module 5R17:

## Integrated System Design

**Leaders:** Dr Per Ola Kristensson and Professor Tony Purnell

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**Timing:** Lent Term

**Prerequisites:** The number of places available on this module is very limited, so preference will be given to 1<sup>st</sup> year PhD students at the Engineering Design Centre.

**Structure:** 8 weekly workshop sessions (3hrs each).

**Format:** Typically, each session will include a 30 min introduction, followed by 2 hrs of hands-on activities and then a 30 min wrap-up discussion.

**Mode of Assessment:** Coursework

### AIMS

The main aim of this module is to introduce students to basic principles of integrated system design. This will include introductions to e.g. identifying requirements, system modelling, project management, risk management, creative design etc. The examples used for illustrating these principles will primarily be from manufacturing and healthcare.

### SYLLABUS

#### Week 1: An Introduction to Integrated System Design

- Motivation for learning principles of integrated system design.
- Introductory discussion giving an overview of the key principles.
- Collaborative design/build project using Lego Mindstorms.

#### Week 2: Understanding the Problem/ System Mapping

- Identifying, structuring and prioritising system requirements.
- Working with stakeholders, considering different perspectives.
- Introduction to different system mapping techniques.

#### Week 3: System Modelling

- Discussion on the relative roles/value of three forms of modelling: back of the envelope calculations, prototyping and numerical simulation.
- The key principles will be illustrated by considering their application to the example of a production line.

#### Week 4: Operations Management

- Discussion on key principles of operations and project management, considered in the context of improving the performance of a production line.
- For this, students will work in teams on the analysis and redesign of a prototype production line made from Lego Mindstorms.

#### Week 5: Risk Management

- Prospective (pre-) and responsive (post-)risk management. An overview of relevant tools, including e.g. FMEA, root cause analysis etc.
- Discussion on the importance for risk management of adopting a disciplined system development process. Introduction to useful project development models, including e.g. the V, waterfall and spiral models.

**Week 6: Creative Design**

- Discussion on the importance of conceptual design.
- An introduction to processes/techniques to support good conceptual design.
- Beginning of a two-week collaborative design/build project.

**Week 7: People/Team Dynamics**

- Understanding the different team roles in effective project teams–based on the Belbin approach.
- Discussion on teamwork, communication and group dynamics.

**Week 8: Wrap-Up**

- Collective feedback from students on key lessons learned from the course.
- Concluding discussion on key principles of integrated system design.
- Presentation from guest lecturer to discuss the relevance of these principles to their own industrial experience (speaker to be confirmed)

**COURSEWORK AND ASSESSMENT**

The coursework is assessed in three parts:

- Session Contribution (30%) – evaluated by leaders after each session;
- Preparation of a plan for the student’s PhD (20%)
- Essay on the influence of systems thinking on the student’s research (50%) – no more than 1,000 words