



## PRODUCT DEVELOPMENT

# FPD001 – Product Design and Development

### 7.5 ECTS Post Graduate course

#### Background

Companies strive to carry out product design and development as a systematic, integrated and managed process. This is the foundation for modern engineering design methodologies. Such methodologies prescribe a systematic process to go from customer needs to finalized product and production system. With this comes the breakdown of the development process into relevant phases, and components of these phases, identification of decision nodes, documentation, and the use of supporting methods and tools. The usage of product design and development methodologies is claimed to reduce lead-times (fewer iterations in late phases), increase quality (systematic requirement control), and the opportunity to create new, and innovative solutions, through the importance that the early concept phase is given and the importance of always working with multiple solution candidates.

There are a number of alternative methodologies that do have a common core, but also contain differences in terms of applicability and underlying philosophy. Some questions that arise are “what is the common core?” and “what differences are motivated by the respective discipline?”.

Furthermore, the practical application in industry has not reached the level anticipated by the “spokespersons” of the methodologies, a fact that points out the need for further, situation-adopted, methodologies.

#### Aim and goal

The course aims to give an overview of the current literature within the field and the practical ability to adopt and implement some of the methodologies in a case study.

After the course, the successful participant should show the following abilities:

- Know central pieces of literature within the product design and development methodologies, including main contents, area of applicability, common vs. diverging components.
- Be able to in detail discuss chosen methodology, including analysis of pros, and cons, application area, and relation to other methodologies
- Be able to apply the chosen methodology as support to solve a product design and development problem of feasible type.
- Be able to discuss trends and development needs within the area of methodologies for engineering design, and product design and development.

#### Course set-up

The course builds upon a number of central literature readings (see literature). In the course, every student group (1–3 persons) choose one of these books for deeper study. The group writes a short write-up on the book that summarizes the parts of the methodology together with an analysis of the applicability in terms of fields, and advantages/disadvantages of the methodology. This work is also presented for the other groups.

The chosen methodology is then applied to a suitable problem and documented in a case report. The results from the write-up and the case study are then presented for the entire class in order to compare and discuss the different methodologies.

Finally, every student writes a reflection report where a personal view on the development needs for the area and analyses the relation between the literature and the personal research field.

## Literature

Below is a list on some books that can be seen as input for the course work. The selection represents central pieces in the “classic” engineering design, and some titles are gathered from closely related areas like Systems, and Software Engineering. It is possible to suggest titles of own choice. Besides the literature list, research papers will be handed out in class.

- Blanchard, B. S., Fabrycky, W. J. (1997) Systems Engineering and Analysis, 3rd ed. Prentice-Hall, New York
- Clausing, D. (1994) Total Quality Development, ASME Press, New York
- Edvardsson, B., Gustafsson, A., Johnson, M. D., Sandén, B. (2000) New Service Development and Innovation in the New Economy. Studentlitteratur, Lund.
- Hull, E., Jackson, K., Dick, J., (2002) Requirements Engineering, Springer-Verlag, London
- INCOSE (2003) Systems Engineering Handbook, ver 2.
- Kruchten, P. (2000) The Rational Unified Process – An Introduction, 2nd ed. Addison-Wesley, New York
- Oliver, D. W., Kelliher, T. P., Keegan, J. G., Jr. (1997) Engineering Complex Systems with Models and Objects, McGraw-Hill, New York.
- Otto, K., Wood, K. (2001) Product Design – Techniques in Reverse Engineering and New Product Development. Prentice-Hall, Upper Saddle River, NJ, USA
- Pahl, G., Beitz, W. (1995) Engineering Design – A Systematic Approach, 3rd ed. Springer-Verlag, Berlin
- Pugh, S. (1990) Total Design. Addison-Wesley, Wokingham, UK
- Roozenburg, N. F. M., Eekels, J. (1995) Product Design: Fundamentals and Methods. Wiley & Sons, Chichester, UK
- Sommerville, I. (2001) Software Engineering, 6th ed., Addison-Wesley, Harlow, UK.
- Stevens, R., Brook, P., Jackson, K., Arnold, S., (1998) Systems Engineering – Coping with Complexity, Prentice-Hall, London
- Suh, N. P. (1990) The Principles of Design. Oxford University Press, New York
- Ullman, D.G. (2003) The Mechanical Design Process, 3rd ed, McGraw-Hill, New York
- Ulrich, K. T., Eppinger, S. D. (1999) Product Design and Development, 2nd ed. McGraw-Hill, New York.
- Wright, I. (1998) Design Methods in Engineering and Product Design. McGraw-Hill, London.

## Examination

To pass on the course the following is required:

- Approved write-up, and oral presentation of chosen literature
- Approved application report (case study) including oral presentation
- Approved reflection report
- Approved opposition on other group presentation

Examiner is Professor Tobias C. Larsson.

## Schedule

The course, that is national, consists of three physical meetings and group work in between the meetings.

## Teachers

The main teachers are (other experts in the field will be involved and invited):

- Professor Tobias C. Larsson

- Division of Functional Product Development, Luleå University of Technology, tobias@ltu.se, <http://www.ltu.se/tfm/fpd>
- Professor Johan Malmqvist
  - Department of Product and Production Development, Chalmers, joma@chalmers.se, <http://www.chalmers.se/ppd/EN/>
- Associate Professor Kjell Andersson
  - Department of Machine Design, Royal Institute of Technology, kan@md.kth.se, <http://www.md.kth.se/>

### **Course homepage**

- <http://www.ltu.se/tfm/fpd/education/phd-studies/phd-courses/pdd?l=en>