



COURSE DESCRIPTION CARD - SYLLABUS

Course name

THE CREATIVE PROCESS AND RESEARCH METHODS IN DESIGN. PRODUCT DEVELOPMENT STAGES [S5AIU>PPMB]

Course

Proposed by Discipline

–

Year/Semester

3/6

Level of study

Doctoral School

Course offered in

English

Form of study

full-time

Requirements

elective

Number of hours

Lecture

4

Laboratory classes

0

Other

0

Tutorials

0

Projects/seminars

0

Number of credit points

1,00

Coordinators

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Lecturers

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Prerequisites

This course focuses on the design process as a systematic and iterative method for creating, developing, and verifying new technical, spatial, product, organizational, and systemic solutions. The classes are interdisciplinary in nature and do not require prior design training specific to any particular discipline. The participant should be able to: - formulate a fundamental research or practical problem related to their own area of interest; - identify the basic constraints and conditions associated with that problem; - present the approach taken to date to solve it; - distinguish between a research problem, a user need, a design requirement, and a proposed solution.

Course objective

The primary objective of the course is to present the design process as a methodical approach to creating new solutions—and arriving at them—through research, analysis, synthesis, experimentation, and verification. Particular emphasis will be placed on the relationship between the research question, the method, the research findings, and the design decision.

Course-related learning outcomes

A doctoral student knows and understands:
P8S_WG/SzD_W03

scientific research methodology in disciplines represented at the Doctoral School.

A doctoral student can:

P8S_UW/SzD_U01

use knowledge from different branches of science to creatively identify, formulate and innovatively solve complex problems or to perform research tasks such as:

- define the aim and subject of scientific research, form a research hypothesis,
- develop research methods, techniques and tools and use them creatively,
- draw conclusions on the basis of research results,

P8S_UW /SzD_U02

critically analyze and assess scientific research results, work of experts and other creative activities together with their contribution into knowledge development.

A doctoral student is ready to:

P8S_KK/SzD_K01

critically assess achievements within a given scientific discipline,

P8S_KK/SzD_K02

critically evaluate their own contribution to development of a given scientific discipline,

P8S_KK/SzD_K03

acknowledge the importance of knowledge in solving cognitive and practical problems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Presentation of the results of team-based workshop activities carried out during class. Grading scale:

- over 50% – 60.0%: 3.0
- over 60% – 70.0%: 3.5
- over 70% – 80.0%: 4.0
- over 80% – 90.0%: 4.5
- over 90% – 100%: 5.0

Programme content

The primary focus is the relationship between the problem, research, solution generation, decision-making, prototyping, testing, and implementation. The design process will be presented as a sequence of activities in which analysis and synthesis, divergent and convergent thinking, experimentation, and iteration complement one another.

The starting point is the premise that design does not begin with an idea for a finished solution, but rather with the recognition of a need, a problem, and opportunities. Equally important is the distinction between "solving a well-defined problem" and the preceding stage of identifying and defining what actually needs to be solved.

The process will be illustrated through a comparison of various design models—specifically the Double Diamond model, the systematic approach of Pahl and Beitz, and the principles of human-centered design.

Course topics

1. Design as a process of creating a new solution:
 - what design is;
 - design as problem-solving and problem framing;
 - design as a process of uncertainty reduction;

problem, need, opportunity, and design challenge;
design as a decision-making process;
design as an iterative process;
relationship between scientific knowledge and design knowledge;
role of criteria, constraints, and requirements.

2. Design process models. Various ways of modeling the process will be discussed:

linear/waterfall model;
iterative model;
divergence and convergence model;
Double Diamond;
agile approaches;
systematic engineering design;
hybrid approaches.

3. Stages of solution development. The process will be presented as a sequence of interconnected activities:

problem recognition;
research and diagnosis;
definition of the problem and requirements;
generating solutions;
selection and development of concepts;
prototyping;
testing and evaluation;
iteration;
finalization;
implementation and assessment of the solution.

4. Research in the design process. Basic types of research will be presented:

desk research and literature review;
analysis of existing solutions;
benchmarking;
analysis of existing data;
observation;
interview;
surveys;
expert research;
user research;
behavioral analysis;
experiment;
functional testing;
prototyping and testing;
participatory research;
contextual research.

5. Generating and developing solutions. Techniques will be discussed, including:

brainstorming;
brainwriting; mind mapping;
analogies;
solution morphology;
SCAMPER;
functional analysis;
design by analogy;
scenarios;
sketching;
rapid prototyping;
co-design;

generating multiple variants.

6. Evaluation and selection of solutions.

evaluation criteria;
functional and technical requirements;
decision matrices;
multi-criteria analysis;
feasibility assessment;
risk assessment;
cost, time, and resources;
usability;
safety;
environmental impact;
implementability.

7. Prototyping, testing, and iteration. The prototype will be presented not merely as a "trial version of the product," but as a tool for gaining knowledge. The following will be discussed:

physical prototypes;
digital prototypes;
models;
simulations;
mock-ups;
scenarios;
service and process prototypes;
user testing;
experiments;
iterative refinement of the solution.

Teaching methods

The course will be conducted using:

problem-based lectures;
visual presentations;
analysis of examples;
short case studies;
moderated discussions;
individual exercises;
teamwork;
a design workshop;
analysis and critique of solutions;

Bibliography

Basic:

Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H. (2007). Engineering Design: A Systematic Approach. Springer.

Cross, N. (2011). Design Thinking: Understanding How Designers Think and Work. Berg.

Design Council. The Double Diamond – Framework for Innovation.

Additional:

Karl T. Ulrich, Steven D. Eppinger, Maria C. Yang (2019)
Product Design and Development, McGraw-Hill Education

Escudero-Mancebo, D., Fernández-Villalobos, N., Martín-Llorente, Ó., et al. (2023). "Research methods in engineering design: a synthesis of recent studies using a systematic literature review." *Research in Engineering Design*, 34, 221–256.

Cash, P., Daalhuizen, J., Hekkert, P. (2023). "Evaluating the efficacy and effectiveness of design methods: A systematic review and assessment framework." *Design Studies*, 88, 101204.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	4	0,00
Doctoral student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation)	21	1,00