

Course 13: Innovative Product Design and Development

Course Objective:

The subject of the course concerns the creative design of innovative products that are technological innovation or modification of existing technological solutions. As a result, designed products should find their application in Industry 4.0 related businesses and its problems. The implementation of the course subject is based on learning and training methods of effective implementation of innovation, identification and analysis of the strategic elements of new product innovation, e.g. the process, different functions, and individual roles. The goal of this course is to develop creative thinking of the graduates and discussion of issues related to development and marketing innovative products, including searching for ideas and creating a concept based on creative thinking techniques and methods of entrepreneurial problem solving, selecting ideas and development of prototypes, taking into account user needs and the latest scientific research.

Learning Outcomes:

The students on the completion of this course would be able to:

- analyze the basic concepts related to innovations and the idea of implementing innovative products (*apply*),
- apply the basic techniques of creative thinking and creative problem solving for creating innovative product and marketing strategies (*apply*),
- identify the benefits of implementing innovations (*analyze*),
- identify the challenges and opportunities associated with the launch of a new product and propose suitable strategies depending on product and situation (*analyze*),
- prepare a conceptual product design taking into account user needs and the latest scientific research (*create*),
- valorization, capitalization and protection of the original solutions obtained from the creative activity (*evaluate*),
- create and co-ordinate cross-disciplinary teams to achieve a common objective (*create*),
- present entrepreneurial and creative attitude towards seeking various problem solutions (*apply*).

Prerequisite: None

Course Outline:

Module 1: Innovation and creativity (Lectures: 5 hours, Workshop: 15 hours, Self-study: 15 hours)

I. Innovation

1. The innovation process and its source
2. Methods of analysis and evaluation of innovations
3. Examples of innovative products

II. Creative thinking and creative problem solving for creating innovative product

1. The concept of creative thinking and creative problem solving
2. Principles and stages of creative problem solving
3. The benefits of creative thinking
4. Difficulties blocking creative thinking, counteracting the suppression of creativity
5. Basic heuristic methods and techniques (mind mapping, brainstorming and its variants, reverse brainstorming, Edward de Bono Methods)

Module 2: Product Design and Development (Lectures: 5 hours, Workshop: 25 hours, Self-study: 25 hours)

III. Creation and development of new products including sustainable development

1. Characteristics of the innovative product
2. Impact of consumers on the design and implementation of innovative products
3. Eco product design

IV. Creating a product design concept based on the design thinking methodology

1. Stages and tools in the design thinking method
 - Stage 1 - Empathy
 - Stage 2 - Defining problems
 - Stage 3 - Generating ideas
 - Stage 4 - Prototyping
 - Stage 5 - Testing
2. Examples of using the design thinking method in the design of innovative products

Module 3: Intellectual Property (Lectures: 5 hours, Workshop: 20 hours, Self-study: 20 hours)

V. Intellectual property

1. The role and importance of intellectual property in business development
2. National, regional and international authorities

VI. Knowledge management techniques

1. Copyrights
2. Related rights
3. Patents
4. Trademarks
5. Industrial design
6. Appellation of origin (Geographical Indications), protection of new varieties of plants, protection of integrated circuits, unfair competition

Laboratory Sessions: None

Learning Resources:

Textbook: No designated textbook, but class notes and handouts will be provided

Reference books and articles:

1. Curedale R.A., Design Thinking Process & Methods 4th Edition, Publisher: Design Community College Inc., 2017.
2. Justice L., The Future of Design: Global Product Innovation for a Complex World, Publisher Nicholas Brealey, 2019.
3. Chesbrough H.W., Open innovation. The New imperative for creating and profiting from technology, Harvard Business School Press, Boston 2003.
4. Liu C. Innovative Product Design Practice, CYPI Press, 2007.
5. Cooper R.G., Edgett S.J., Product Innovation and Technology Strategy, Booksurge Publishing, 2009.
6. Gessinger G.H., Materials and Innovative Product Development, Publisher Butterworth-Heinemann, 2009.
7. Patton J., Economy P., User Story Mapping: Discover the Whole Story, Build the Right Product Published O'Reilly Media, 2014.
8. Alves R., Nunes, N.J., Towards a Taxonomy of Service Design Methods and Tools, (in:) Falcão e Cunha J., Snene M., Nóvoa H. (eds.), Exploring Services Science. Lecture Notes in Business Information Processing, 2013, 215-229, Springer, Berlin, Heidelberg.
9. Zawadzki P., Żywicki K., Smart product design and production control for effective mass customization in the Industry 4.0 concept, „Management and Production Engineering Review”, 2016, 7, 3, 105- 112.

Teaching and Learning Method:

This course will be implemented through the lectures, workshops and self- studies. The teaching and learning methods during workshops and self- studies include class discussion, analysis of examples, identification of customer needs, individual/ group generation of the product concept and its critical assessment, as well as simple prototyping of a product. Workshops will be conducted among others by the Design Thinking method. Students will gain the ability to moderate according to the Design Thinking methodology, which creates innovative solutions, products, services and processes. They will acquire the ability to search and recognize challenges that can be conducted according to the Design Thinking methodology. They will learn the rules for selecting project teams. Students will acquire ability to use teamwork to achieve the group's intended goal and result.

Time Distribution and Study Load:

Lectures: 15 hours

Workshop: 60 hours

Self-study: 60 hours

Time allocation table

Session	Activities	Time allocation
I. <u>Innovation</u>	Lecture	2
	Workshop	5
	Self-study	4
II. <u>Creative thinking and creative problem solving for creating innovative product</u>	Lecture	3
	Workshop	10
	Self-study	11
III. Creation and development of new products including sustainable development	Lecture	2
	Workshop	7
	Self-study	5
IV. Creating a product design concept based on the design thinking methodology	Lecture	3
	Workshop	11
	Self-study	20
V. Intellectual property	Lecture	1
	Workshop	5
	Self-study	5
VI. Knowledge management techniques	Lecture	4
	Workshop	15
	Self-study	15

Assessment scheme:

During lectures:

- Class discussions
- Test

During workshops and self-studies:

- Class discussions
- Individual presentation of assignments
- Individual tasks for a group project
- Progress a group project
- Project outcome
- Final presentation of group project

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6	CLO 7	CLO 8
Class discussions (15%)	9	3	3	3	9	9	3	3
Individual presentation of assignments (15%)	3	3	3	1	3	3	1	3
Individual tasks for the group project (15%)	3	9	3	9	9	1	1	3
Progress the group project (10%)	3	9	9	9	9	3	9	9
Project outcome (10%)	3	9	9	9	9	3	3	3
The final presentation of the group project (20%)	3	9	9	9	9	3	3	3

Test (15%)	3	1	3	1	1	3	1	1
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Assesment model:

9: Strong, 3: Moderate, 1: weak

Evaluation Scheme: The final grade will be computed according to the following weight distribution: Class discussions (15%); Individual presentation of assignments (15%); Individual tasks for a group project (15%); Progress a group project (10%); Project outcome (10%); Final presentation of group project (20%); Test (15%).

An “A” would be awarded if a student shows a deep understanding of the knowledge about innovative product design and development.

A “B” would be awarded if a student shows an overall understanding of all topics about innovative product design and development.

A “C” would be given if a student meets below average expectation in understanding and application of basic knowledge about innovative product design and development.

A “D” would be given if a student does not meet expectations in both understanding and application of the given knowledge about innovative product design and development.

Instructor: