COURSE DESCRIPTION CARD - SYLLABUS

Course name
CREATIVE ENGINEERING PROBLEMS SOLVING [S5SD1>KRPI]

Course

Proposed by Discipline
–

Year/Semester
3/5

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

Knowledge: basic knowledge of engineering, management, mathemetics. Skills: ability to solve elementary problems of engineering based on possessed knowledge, usage of mathematical and engineering issues, the ability to acquire information from indicated sources. Social competences: understanding the need of further education, willingness to cooperate with a team.

Course objective

1. Obtaining knowledge of engineering problems solving methods in the scope determined by the content of the curriculum, appropriate for the field of study. 2. Development of skills to solve engineering problems, perform simple and advanced analysis of problem solving based on gained knowledge. 3. Developing teamwork skills.

Course-related learning outcomes

Knowledge:
A PhD student who graduated from doctoral school knows and understands:
1) The extent that enables revision of existing paradigms - global achievements, covering theoretical basis as well as general and selected specific issues, that are characteristic to scientific disciplines studied at the doctoral school, [P8S_WG/SzD_W01]
2) Key developmental trends of science disciplines in which education takes place at the doctoral school,

[P8S_WG/SzD_W02]
3) Scientific research methodology in disciplines represented at the doctoral school, [P8S_WG/SzD_W03]

Skills:
A PhD student who graduated from doctoral school can:
1) Use the knowledge from different branches of science to creatively identify, formulate and to innovatively solve complex problems or to execute research tasks in particular: - 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_U01]
2) Critically analyze and asses scientific research results, work of experts and other creative activities together with their contribution into knowledge development, [P8S_UW/SzD_U02]
3) Transfer the results of scientific activity to the economic and social sphere, [P8S_UW/SzD_U03]
4) Communicate on specialist issues at the level that allows active participation in international scientific community, [P8S_UK/SzD_U04]

Social competences:
A PhD student who graduated from doctoral school is ready to:
1) Critically assess the achievements within a given scientific discipline, [P8S_KK/SzD_K01]
2) Critically evaluate their own contribution to the development of a given scientific discipline, [P8S_KK/SzD_K02]
3) Acknowledge the importance of knowledge in solving cognitive and practical problems, [P8S_KK/SzD_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

W01, W02, W03
Case studies - active participation in discussion and problem solving exercises.
Assessment: Quality of the feedback provided; assessment of the students' work in the classroom.

U01, U02, U03, U04
Project - development of an creative problem solving analysis.
Project assessment - final score.

K01, K02, K03
Readings - class discussion. Team work.
Assessment of the quality of class discussion.

Programme content

Description of the Creative Engineering Problem Solving Process. Creative tools. The difference between troubleshooting techniques. Advanced problem-solving methods. Algorithmic creative thinking. Innovative thinking and basics of TRIZ algorithm.

Course topics

1. Creative Engineering Problems Solving Process. Creative tools, The task or problem? Creative design. Define problems.
2. Simple troubleshooting techniques, such as: mind maps, Quintilianus Questions, scribble da Vinci, Arnolds Postcards, SCAMPER, DOIT, questioning assumptions, reamer view and ideas De Bono, etc.
3. Advanced problem-solving methods, such as. Simplex, brainstorming, sketching mind, six thinking hats, etc.
4. Algorithmic creative thinking: innovative thinking and basics of Altshullers TRIZ algorithm

Teaching methods

Lecture: Multimedia presentation including illustrations and examples.

Bibliography

Basic:

1. Buzan Tony, Mind Map Mastery: The Complete Guide to Learning and Using the Most Powerful Thinking Tool in the Universe, 2018.
2.VanGundy B. A., "101 Activities for Teaching Creativity and Problem Solving", Pfeiffer and John Wiley & Sons Inc. San Francisco 2007, p. 391.
3. C. Cempel, "Inżynieria Kreatywności w Projektowaniu Innowacji", Wydawnictwo ICT PIB Radom - Poznań 2013.
4. Savransky Semyon D., "Engineering of Creativity - Introduction to TRIZ Methodology of Inventive Problem Solving" CRC Press, Boca Raton, New York, USA, 2000.
5. Eder W. E., Hosnedl S., Design Engineering - A Manual for Enhanced Creativity, CRC Presss, New York 2008, p. 588.
6. Gardner H., "Frames of the Mind', Basic Books, New York 1983, p. 440.
7. Tan O. S., (edit), "Problem Based Learning and Creativity", CENGAGE Learning, Singapore, 2009, p. 244.

Additional:
1. Orloff M. A., Inventive Thinking through TRIZ - a practical guide, Springer, Berlin 2006, p. 351.
2. Rantanen K., Domb E., "Simplified TRIZ - New problem Solving Applications for Engineers and Manufacturing Professionals", CRC Press Company, London, 2002, p. 251.
3. Clegg B., Birch P., "Przyspieszony Kurs Kreatywności", Wyd. One Press, Warszawa, 2007, s. 336.
4. DeBono E., "Naucz Swoje Dziecko Myśleć", Wyd. Prima, Warszawa 1996.

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