COURSE DESCRIPTION CARD - SYLLABUS

Course name

Optimal structure design

Course

Field of study

Management and production engineering

Year/Semester

2/3

Area of study (specialization)

Computerization of production

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Wydział Inżynierii Mechanicznej

ul. Piotrowo 3 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Basic knowledge in mathematics and other areas in the field of study.

Ordered theoretical knowledge in the field of study.

Ability to solve mathematical problems in the field of study.

Capability to search for necessary information in literature, databases, the Internet and in the given sources.

Ability to self-study and self-education.

Ability to use information and communication techniques relevant to the implemen-tation of engineering tasks.

Understanding the need to learn and expand their knowledge throughout their lives.

Understanding non-technical aspects and effects of engineering activities.

Willingness to cooperate in a team.

Course objective

Presentation in a concise and intelligible form basis for optimum design of constructions, as well as other equipment and technical systems. Emphasizing the design process as an action based on a systemic (holistic) approach, using solutions based on the so-called nature lesson. Presentation of the basic concepts of optimal design, discussion of basic optimization procedures. Overview of the basics of multi-criteria optimization. Presentation of modern optimization procedures using a "nature lesson". Acquiring the ability to find optimal solu-tions for simple technical systems within the laboratory.

Course-related learning outcomes

Knowledge

1. Possessing the necessary theoretical knowledge on structure optimization to the extent necessary for the field of study.

2. Knowledge of basic concepts and computational procedures necessary for optimal design.

3. Knowledge of development trends, new procedures and calculation methods used in practical design processes.

4. Understanding the systemic aspects of engineering activities, including activities in the field of optimal design.

Skills

1. Ability to apply selected optimization procedures, the ability to use optimization procedures contained in mathematical packages.

2. Finding optimal solutions for simple technical systems.

3. Understanding the importance of a system approach to the problem of optimization.

4. Ability to use methods found in nature to solve complex technical problems.

5. A student is able to assess various design options and identify the optimal solution taking into account many different criteria.

Social competences

1. Understanding the need for self-study associated with the development of technology.

2. Appreciating and understanding the social and systemic effects of engineering activities.

3. Understanding the importance of teamwork.

4. The ability to make the right decisions and making decisions relevant to the problem.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: assessment based ona a written test:

3.0 - 50,1%-60,0%

3.5 - 60,1%-70,0%

4.0 - 70,1%-80,0%

4.5 - 80,1%-90,0%

5.0 - 90,1%-100,0%.

Laboratory: assessment based on activity during classes and solving the assigned task

Programme content

Introduction to the basics of optimal design of engineering structures. Basic concepts and terms of optimization (criteria, decision variables, limiting conditions). Discussion of construction models and optimization models. Classification of optimization problems.

Optimization of the function of one variable - analytical and numerical methods.

Non-linear programming without constraints - necessary and sufficient conditions for the existence of extremum, optimization procedures.

Nonlinear programming with constraints - necessary and sufficient conditions for the existence of an extreme (Lagrange function, Kuhn-Tucker conditions), numerical methods for searching for a minumum of a function (methods with a penalty function).

Multi-criteria optimization - theoretical foundations and explanation of optimization procedures.

Teaching methods

Live lecture with multimedia illustrations.

Laboratory - tasks solved on the board and using a computer in Matlab.

Bibliography

Basic

[1] Marian Ostwald: Podstawy optymalizacji konstrukcji w projektowaniu systemowym. Wydawnictwo Politechniki Poznańskiej, wydanie I, 2016.

Additional

[1] Eschenauer H., Koski J., Osyczka A., Multicriteria design optimization, procedures and applications. Springer-Verlag, Berlin 1990.

[2] Rao S. S., Engineering optimization - theory and practice, John Wiley and Sons, 1996.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, solving the assigned task) [1]	20	1,0

[1] delete or add other activities as appropriate