COURSE DESCRIPTION CARD - SYLLABUS

Course name

Finite Element Method

Course

Field of study

Education in Technology and Informatics

Year/Semester

1/2

Area of study (specialization)

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

english

Form of study

full-time

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

dr hab. Tomasz Stręk

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Responsible for the course/lecturer:

Prerequisites

Knowledge of mathematics, mechanics, fluid mechanics, strength of materials, heat transfer and differential equations, numerical methods. Skills of logical thinking, the use of information obtained from the library and the Internet. Social competencies of understanding the need for learning and acquiring new knowledge.

Course objective

The student should obtain knowledge of theoretical and computational fundamentals for solution of basic linear and non-linear partial differential equation problems modeling and governing technical,

engineering and nature problems. Theoretical and practical knowledge of computing using finite element method/analysis to solve the basic problems of linear and nonlinear scientific and technical issues described by partial differential equations (stationary and non-stationary problems).

Course-related learning outcomes

Knowledge

1. Has an extended and deepened knowledge of mathematics, useful for modeling and computer simulation of the course of processes, as well as the operation of devices and systems [K2_W02].

Skills

1. Can use the acquired mathematical knowledge to describe processes, create models and write algorithms [K2_U01].

2. Is able to develop a computational model of a physical system, including a finite element model, perform an analysis of the system, and then interpret the results of the simulations [K2_U17].

Social competences

1. Can interact and work in a group, assuming different roles in it [K2_K03].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Assessment on the basis of the project of the developed problem / issues in the field of content of issues performed in the lectures. The form and quality of prepared materials is assessed (description of issues, theory, method, results, analysis and literature).

Programme content

Lecture:

1. Mathematical foundations of the finite element method.

2. Partial differential equations.

3. Getting to know the system for calculations using the finite element method (eg Comsol Multiphysics).

4. Solving basic partial differential equations.

5. Modeling and solving the problem of heat transfer.

6. Modeling and solving problems of solid mechanics.

7. Modeling and solving problems of thermal deformations.

8. Modeling and solving the problem of fluid mechanics (stationary and part-time).

9. Modeling and solving the problem of fluid flow interaction and heat transfer.

Teaching methods

Lecture: lecture / problem lecture / lecture with multimedia presentation.

The content of the lecture is presented in the form of a multimedia presentation in combination with a classic blackboard lecture enriched with shows related to the issues presented.

Bibliography

Basic

O.C. Zienkiewicz , R.L. Taylor , The Finite Element Method, Volume 1-3, 5th edition, Butterworth-Heinemann, Oxford, 2000. (7th edition - 2013: https://www.elsevier.com/books/the-finite-element-method-its-basis-and-fundamentals/zienkiewicz/978-1-85617-633-0)

William B. J. Zimmerman, Multiphysics Modeling With Finite Element Methods, Series on Stability Vibration and Control of Systems, Series A - Vol. 18, 2006.

Andriy Milenin, Podstawy metody elementów skończonych. Zagadnienia termomechaniczne, Wydawnictwo AGH, 2010.

Stefan Wiśniewski, Tomasz S. Wiśniewski, Wymiana ciepła (wyd 6), PWN, Warszawa, 2017.

Adrian Bejan, Allan D. Kraus, Heat Transfer Handbook, John Wiley & Sons, Inc., Hoboken, New Jersey, 2003.

Allan F. Bower, Applied Mechanics of Solids, http://solidmechanics.org/index.html

Introduction to Structural Mechanics: https://www.comsol.com/multiphysics/introduction-to-structural-mechanics

Additional

Taler J., Duda P.: Rozwiązywanie prostych i odwrotnych zagadnień przewodzenia ciepła, WNT, Warszawa 2003.

Mechanika techniczna. Komputerowe metody ciał stałych, pod red. M. Kleibera, PWN, Warszawa, 1995.

Wiesław Pudlik, Wymina i wymienniki ciepła, Politechnika Gdańska, Gdańsk 2012 (źródło: http://pbc.gda.pl/Content/4404/wymiana-i-wymienniki-final.pdf)

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	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, project preparation) [1]	30	1,0

[1] delete or add other activities as appropriate