COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computational Structure Analysis [S1MiBM1>MASt]

Course

Field of study
Mechanical Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

Lecturers

Prerequisites

KNOWLEDGE: the student has basic knowledge of information technology and mechanical engineering. SKILLS: the student is able to integrate the obtained information and interpret it SOCIAL COMPETENCES: the student is able to cooperate in a project team, is aware of the responsibility for the tasks performed, understands the need to acquire new knowledge

Course objective

Introduction to the Finite Element Method for static structural problems based on DSM. Acquiring knowledge and skills concerning the numerical aspects of FEM (definition of the element matrix, aggregation of the global stiffness matrix of the system, boundary conditions, solution of the system of equations). Acquiring practical skills in using specialized software. Acquisition of IT skills useful in the integration of CAD / CAE tools, including automation (pipelines) of processing of computational tasks.

Course-related learning outcomes

Knowledge:
Has basic knowledge of information technology and computer science in the use of software in the processes of processing and presenting information, allowing the use of: the basics of algorithms, compilers and programming languages, procedural and object-oriented programming, computational techniques, software and internet tools, computer-aided engineering systems in mechanical engineering

and technology.
Has ordered, theoretically founded knowledge of technical mechanics, including computational methods in mechanical engineering.

Skills:
Can develop documentation for the implementation of an engineering task in the field of mechanical engineering and prepare a text containing a discussion of the results of this task.
Can use the known methods and IT tools in mechanical issues, also in order to automate computer simulations and automatically process and document their results.
Can assess the usefulness of routine methods and tools for solving a simple engineering task of a practical nature and select and apply the appropriate method and tools.

Social competences:
Understands the need for lifelong learning; can inspire and organize the learning process of other people.
Can properly define priorities for the implementation of a task set by himself or others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Oral and written tests. Assessment of individually made tasks.

Programme content

Discussion of the concept of the Finite Element Method, FEM formulation and computer applications of FEM. Explanation of the concepts of computer mechanics in applications to the linear theory of elasticity, spatial discretization problems, creation of local and global matrices, boundary conditions and computer solving of the obtained equations.
FEM implementation in a computer algebra environment (Matlab / Octave / Python + NumPy + SciPy).
FEM analyzes of selected problems in the field of mechanical engineering in commercial, open-source and class software. Analysis of the correctness of the results - validation of solutions.
Basics of scripting programming languages (eg Python, shell / BASH) and automation of the processing pipeline in computational problems (FEM simulation).

Teaching methods

Information / problem lecture, case study, computer lab.

Bibliography

Basic
O.C. Zienkiewicz: Metoda Elementów Skończonych. WNT Warszawa 1977
J. Kruszewski, E. Wittbrodt, Z. Walczyk: Drgania układów mechanicznych w ujęciu komputerowym, T II, zagadnienia wybrane, Seria Wspomaganie Komputerowe CAD/CAM, WNT-Warszawa, 1996
M. Kleiber: Komputerowe Metody Mechaniki Ciał Stałych, PWN 1995, ISBN 83-01-11740-0
Additional
E. Rusiński, Metoda Elementów Skończonych.COSMOS/M, WKŁ Warszawa 1994

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	40	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	35	1,50