COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computational methods of structural mechanics

Course

Field of study
Mechanical engineering

Year/Semester
3/6

Area of study (specialization)
-

Profile of study
general academic

Level of study
First-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

3

Lecturers

Responsible for the course/lecturer:
dr Tomasz Walczak

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of differential calculus, continuum mechanics and numerical methods. Ability to use acquired engineering knowledge in technical aspects of human activity.

Course objective

Acquiring basic knowledge about computational methods used to solve engineering problems. Acquiring the ability to search for approximate methods of solving engineering problems.

Course-related learning outcomes

Knowledge

1. Knowledge of basic issues related to the mathematical description of physical phenomena.

2. General knowledge about approximate methods of solving engineering problems.

3. Knowledge of basic IT tools needed to implement the computational methods.

4. Knowledge of different approaches in modeling physical phenomena for selected engineering issues.

Skills

1. Acquiring information from the Internet and literature on IT tools used to implement computational methods.

2. Ability to plan numerical experiments to solve engineering problems.

3. The ability to independently expand the scope of knowledge about modern computational methods.

4. The ability of modeling the physical phenomena formulation simplifying assumptions and selection and implementation of appropriate computational method to solve some problems of structural mechanics.

Social competences

1. Understands the need for learning and continuous improvement of qualifications; can organize the learning process of others.

2. Is aware of the role of engineering knowledge and its importance for society and the environment.

3. Is able to set priorities for the implementation of a specific task.

4. Is aware of the responsibility for using engineering knowledge for the benefit of society.

5. Understands the need to formulate and provide the public with information and opinions on the achievements of technology.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Credit based on a test consisting of general questions and tasks related to the computer implementation of selected computational methods. The sum of points scored for correct answers translates into the scale rating:

0% -49% - 2.0, 50% -59% - 3.0, 60% -69% - 3.5, 70% -79% - 4.0, 80% -89% - 4.5, 90% -100% -5.0.

Laboratory: Credit based on implemented computational methods that solve individually received engineering problems in any computational (programming) environment.

Programme content

Lecture:

1. Computational methods - basic concepts.

2. The implementation scheme of the calculation method.

3. Errors that appear in the process of implementing the computational method. Verification of results.

4. Mathematical description of engineering issues.

5. Computational methods used in structural mechanics: Finite Element Method (FEM), Method of Fundamental Solutions (MFS), Finite Differences Method (FDM).

6. Detailed discussion of FDM: solution design, differential schemes for linear operators, algorithm description, applications.

7. Advantages and disadvantages of discussed calculation methods and differences between them.

8. Examples of applications in engineering issues - searching for distribution of displacement field, stress, stationary heat conduction, plate deflection.

Laboratory: implementation of examples of FDM and MFS applications presented in the lecture in engineering issues in the Scilab environment.

Teaching methods

Lecture: lecture illustrated by a multimedia presentation containing the discussed program content

Laboratory: solving tasks, conducting numerical experiments

Bibliography

Basic

1. Mechanika techniczna. Komputerowe metody ciał stałych, M. Kleiber, PWN, Warszawa, 1995.

2. Numerical Methods for Engineers, S.C. Chapra, R.P. Canale, McGraw-Hill Book Company , 1989.

3. Numerical Analysis, R.L. Burden, J.D. Aires, PWS-Kent, Boston, 1985.

Additional

1. Wprowadzenie do ćwiczeń laboratoryjnych z metod numerycznych, Cichoń Cz., Cecot W., Krok J., Pluciński P., Politechnika Krakowska, Kraków, 2002.

2. Metody komputerowe w liniowej mechanice konstrukcji, Cichoń Cz. Politechnika Krakowska, Kraków 2002.

Breakdown of average student's workload

	Hours	ECTS
Total workload	70	3,0
Classes requiring direct contact with the teacher	40	1,5
Student's own work (literature studies, preparation for /tutorials, preparation for test, project preparation) [1]	35	1,5

[1] delete or add other activities as appropriate