COURSE DESCRIPTION CARD - SYLLABUS

Course name

Extreme civil engineering

Course

Field of study

Budownictwo

Year/Semester

2/4

Area of study (specialization)

IPB

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

elective

Number of hours

Lecture

10

Laboratory classes

10

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

dr hab. inż. Wojciech Sumelka, prof. nadzw.

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Wydział Inżynierii Lądowej i Transportu

ul. Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Knowledge: Mathematics: foundations of differenctial, integral and matrices calculuses; Structural Mechanics, Strength of Materials and Theory of Elsticity on the level of 6 according to KRK system; Numerical Methods and Information Technology on the level of 6 according to KRK system;

Skills: The Student is able to follow through the static analysis of beam structures; Uses the displacement method for solving beam systems; The Student uses the selected software tools of computer analysis and design of structures;

Social competencies: Understand the role of continuous education in teh direction of the study but also other technical sciences;

Course objective

Extreme civil engineering - includes architectural, structural and technological-organizational solutions that diverge significantly from those commonly used and go beyond standards. It is a construction based on the latest research results and includes cubature, linear as well as complex objects. The fact that more and more examples of extreme solutions in civil engineering appears is a result of rivalry between investors and engineers.

The main objectives of the subject:

acquainting the student with the latest achievements of non-linear structural mechanics as a fundamental component of the design process in extreme construction.

Course-related learning outcomes

Knowledge

1. have extended and detailed knowledge of mathematics, physics and chemistry, forming theoretical principles appropriate to formulate and solve tasks related to building engineering.

2. know key issues of continuous medium mechanics; principles of analysing the issues of statics, stability and dynamics.

3. have extended and detailed knowledge of material strength, modelling and constructing;

have knowledge of theoretical principles of the finite element method as well as general rules of non-linear calculations of engineering structures.

4. have detailed knowledge in the field of operation algorithms of selected software supporting the analysis and design of building facilities, which are also useful to plan and manage construction projects, including Building Information Modelling (BIM).

5. have advanced and detailed knowledge of the theoretical principles of structure analysis and optimization as well as design of selected building units.

Skills

1. can perform a classical static and dynamic analysis and stability analysis of statically determinate and non-determinate bar structures (trusses, frames and strands); as well as surface construction (discs, plates, membranes and shells).

2. use advanced specialized tools in order to search for useful information, communication and in order to obtain software supporting the designer and organizer of building engineering works.

3. are able to correctly define a computational model and carry out an advanced linear analysis of complex building units, their elements and connections; are able to apply basic nonlinear computational techniques together with a critical evaluation of numerical analysis results.

4. utilizing the obtained knowledge, they can select appropriate (analytical, numerical, simulation, experimental) methods and tools to solve technical problems.

5. applying scientific rules and skills, are able to formulate and test hypotheses related to simple research problems, in order to solve engineering, technological and organisational problems in construction engineering; can prepare studies preparing for research work.

Social competences

1. take responsibility for the reliability of working results and their interpretation.

2. are responsible for the safety of own work and team work.

3. can realise that it is necessary to improve professional and personal competence; are ready to critically evaluate the knowledge and received content.

4. can realise how important it is to take care of health and physical fitness.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The lectures are finished with final assesment which consists of two parts - written test (1,5 hour) and if necessary oral one. In the written part the Students answer to 4-6 questions (problems). After reviewing the oral part is only for those who are the best in the group. It is necessary to obtain 50% points.

During the labs the progres in the work of Students is evaluated. The marks are offered for every problem that has to be solved. It is necessary to obtain 50% points.

Programme content

Lecture Schedule:

- basic of damage and fracture mechanics and

- coupled field problems (thermo-mechanical, acoustic-structural, fluid-structure),

- composite materials, structural glass, wood (solid and glued) and others.

Summary of lectures.

Laboratory Schedule:

- modeling of steel / reinforced concrete / masonry / wooden structures taking into account damage,

- structures in failure / wear configuration,

- glass constructions,

- constructions made of composite materials

- other.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board.

2. Laboratory: multimedia presentation, illustrated with examples given on a board, and performance of tasks given by the teacher.

Bibliography

Basic

1. T.Łodygowski, W.Kąkol, Metoda elementów skończonych w wybranych zagadnieniach mechaniki konstrukcji inżynierskich, dostępne na stronie internetowej Zakładu Komputerowego Wspomagania Projektowania

2. G.Rakowski, Z. Kacprzyk, Metoda elementów skończonych w mechanice konstrukcji, Oficyna Wydawnicza Politechniki Warszawskiej

3. M. Kleiber, P.Kowalczyk, Wprowadzenie do nieliniowej termomechaniki ciał odkształcalnych, IPPT PAN, 2011

4. J. Ostrowska-Maciejewska, K. Kowalczyk-Gajewska, Rachunek tensorowy w mechanice ośrodków ciągłych, IPPT PAN, 2013

Additional

1. O.C.Zienkiewicz, (R.Taylor), The finite element method, wyd. 1 - 6, 1972 - 2007

2. T.J.R.Hughes, The finite element method. Linear static and dynamics, Prentice-Hall Eds., 1987

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,0
Classes requiring direct contact with the teacher	20	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	40	1,0

[1] delete or add other activities as appropriate