Tadeusz Kosciuszko Cracow University of Technology

Course Card

Faculty of Civil Engineering

Field of study: Civil Engineering

Study profile: general academic

Study form: full-time

Field of study code: BUD

Study cycle: 1st

Specialty: no specialty

1 COURSE INFORMATION

Course name	Metody obliczeniowe
Course name in English	Computational Methods
Course code	WIL BUD oIS B14 24/25
Course category	Przedmioty podstawowe
No. of ECTS points	3.00
Semester	4

2 CLASS TYPE, NUMBER OF HOURS ACCORDING TO THE STUDY PLAN

Semester	Lecture	Class exercise	Laboratory	Computer lab	Design exercise	Seminar
4	15	0	0	30	0	0

3 COURSE OBJECTIVES

Objective 1 Student should get acquainted with mathematical modelling, in particular local and global formulation of problems of mathematical physics

Objective 2 Student should learn about methods of finding approximate solutions, in particular Finite Element Method (FEM), and get prepared to participation in scientific research

Objective 3 Student should learn FEM for bar structures

Objective 4 Student should learn FEM two-dimensional problems of stationary heat transfer and continuum mechanics

4 PREREQUISITES IN TERMS OF KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1 Knowledge from courses of mathematics, information technology, applied mathematics and numerical methods, in particular the following subjects: functions of many variables, differential and integral calculus, differential equations, matrix and tensor calculus, basics of programming in a mathematical package, solution of set of linear equations, approximation, interpolation, numerical integration, foundations of finite difference method

5 LEARNING OUTCOMES

LO1 Skills Ability to derive global formulation of a problem from local one

LO2 Skills Ability to find approximate solution of a simple ordinary differential equation using FEM

LO3 Knowledge of FEM algorithm for bar structures

LO4 Skills Ability to find FE solution for two-dimensional bar structure (truss, beam, frame)

LO5 Knowledge of formulation and FEM algorithm for two-dimensional problem of stationary heat flow

LO6 Knowledge Ability to solve two-dimensional problem of stationary heat flow using FEM

LO7 Knowledge of formulation and FEM algorithm for plane stress problem

LO8 Knowledge Ability to solve plane stress problem using FEM

LO9 Knowledge Ability to assess critically obtained results of numerical analysis

6 COURSE CONTENT

Laboratory computer		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
K1	FEM package for civil engineers - introduction, solution of a beam, truss and frame - exercise	6
K2	Solution of ODE using FEM - exercise	2
K3	Solution of bar structures using FEM (assignments 1, 2)	8
K4	Simulation of heat flow using general purpose FE code and mathematical package (assignment 3)	6
K5	Computation of stresses in a panel using FEM package for civil engineers (assignment 4)	4
K6	Delivery of assignments	2
K7	FEM for buckling or dynamics - exercise	2

Lecture		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
L1	Computer simulations in mechanics and engineering, mathematical modelling	1
L2	Local and global formulation of BVPs, approximation, Galerkin method	1
L3	Finite element method (FEM)	1
L4	FEM for bar structures	4
L5	FEM formulation for 2D problems - stationary heat flow	2
L6	Overview of 1D/2D/3D elements	1
L7	FEM for 2D problem of statics of a panel (plane stress)	2
L8	Estimation of approximation error	1
L9	Isoperimetric finite elements	1
L10	Simulations of frame buckling or vibrations using FEM	1

7 TEACHING TOOLS

N1 Lecture

N2 Discussion

N3 Multimedia presentation

N4 Laboratory exercise

8 Student workload

Activity form	Number of hours of activity
Hours realized in contact with the teacher	
Hours resulting from the study plan	45
Consultation hours	0
Exams and tests during session	0
colloquia	4
Hours of autonomous student work	
Preparing for classes, studying literature	15
Developing results	10
Preparing of reports, projects presentations, discussion	15
Total number of hours devoted to the subject	**89**
Total number of ECTS points	3.00

9 Methods of grading

Partial gradesF1

Individual project **F2**

Practical exercise

Summary grade

P1 Average grade from 2 tests

P2 Weighted average of the midterm tests grades

Conditions for passing the course

L1 The presence at laboratory exercises is compulsory (student can be absent maximum 3 times). If an assignment report is delivered with a delay, the grade will be lowered

L2 Assignments 1 and 2 have to be delivered before test 1, assignment 3 before the end of classes. Assignment 4 should be delivered by the summer break

L3 Test 1 takes place at additional classes scheduled in contact with students. There is one more opportunity to take each tests (resit). In justified cases, one more resit can be held in examination session

L4 The grade recorded in student's study record is computed as weighted average of lab grade and average grade from tests

Assessment of activity without teacher participation

B1 Individual project

B2 Test