COURSE DESCRIPTION CARD - SYLLABUS

Course name

Computer Assissted Engineering Problems

Course

Field of study

Mechanical engineering

Area of study (specialization)

Year/Semester

1/1

Profile of study

Level of study

Second-cycle studies

Form of study

full-time

Course offered in

Polish

Requirements

compulsory

Number of hours

Lecture

Tutorials

Laboratory classes

15

Projects/seminars

Other (e.g. online)

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

dr hab. eng. Anita Uscilowska

email: anita.uscilowska@put.poznan.pl

tel. +48 61 665-2265

Faculty of Mechanical Engineering

3 Piotrowo St., 60-965 Poznan

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of physics, mathematics and mechanics; skills of logical thinking; association of knowledge of many branches; getting and using information form library and internet; social expertise: needs of continuous learnig, getting new knowledge

Course objective

Getting knowledge about applying of chosen numerical method forsolving engineering problems

Course-related learning outcomes

Knowledge

1. Student has extended and well-founded knowledge in mathematics including solving discrete equations in a conventional way and by means of Z-transform, determination of matrix eigenvalues, eigenvectors and modal matrix, solving nonlinear ordinary and partial linear equations to describe complex mechanical issues [K_W01].

Skills

1. Student knows how to retrieve information from literature, databases and other properly selected sources, also in English or another language deemed as the language of international communication in the area of the course; knows how to integrate the retrieved information, how to integrate and interpret it and then critically evaluate as well as to how draw conclusions and formulate and fully justify opinions [K_U01].

2. Student is able to work individually and in teams, knows how to use information and communication technologies typically used in implementation of engineering activities, knows how to use a variety of techniques to communicate in a team and in an environment, also in English or another foreign language deemed as the language of international communication in the area of mechanical engineering [K_U02].

3. Knows how to formulate selection criteria for a relevant mathematical method to solve a given engineering problem. He/she knows how to apply a relevant mathematical method to solve an engineering problem. He/she knows how to use basic methods of statistical analysis to evaluate measurements of technical values. He/she knows how to approximate non-linear and transcendental equations and determine interpolation polynomial for experimental results [K_U06].

Social competences

1. Student is well aware of the necessity for continuous learning; knows how to inspire and organize the process of learning of other people [K_K01].

2. Student knows how to cooperate and work in teams assuming various roles within [K_K03].

3. Student knows how to prioritize steps in order to carry out a task either defined by him/herself or by others [K_K04].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written test of 5 excerises of subjects realised during semester (positive note for minimu 3 correct answers: <3 - ndst, 3 - dst, 3,5 - dst+, 4 - db, 4,5 - db+, 5 - bdb) done at theend of semester.

Programme content

1.An introduction to engineering calculation. Estimation of numerical correctness of chosen algorithms.

Preparation of algorithm and testing the methods:

2. Calculation of the elements length of mechanisms (mechanics), calculation of friction coefficient based on Colebrooke-White equation (fluid mechanics) - methods: bisection, Newton's;

3. Calculation of stamping coefficient based on table data (metal forming) - Interpolation of a function with one variable (Lagrange interpolation polynomial, difference quotients, Newton interpolation polynomial, cubic spline functions interpolation)

4. Calculation of area, moment of inertia of plane figures, volume, mass and weight of 3D elements (mechanics), calculation of integrals, which are analytically undetermined and appearing in engineering problems - elliptical integrals - numerical integration (composite trapezoid rule, composite Simpson's integration);

5. Calculation of parameters of hardening curve of some chosen materials based on table data (metal forming) - approximation in sense of least square method;

6. Solving problem of pendulum movement (mathematical, physical pendulum), intoduction to determined chaos (mechanics) - solving initial value problem with one variable: Euler, Taylor and Runge-Kutta methods and Runge-Kutta approach for initial value problems with system of equations

7. Solving problem of stationary temperature field in elements under metal forming processes, i.e. FlowDrill technology - numerical methods for solving one-dimensional boundary value problems: shooting method, finite difference method.

Teaching methods

Numerical experiment - computer simulations; Presentation of obtained results; practical work of students - preparing of computer programs to perform simulation; discussion;

Bibliography

Basic

1. Fortuna Z., Macukow B., Wąsoski J., 2001, Metody numeryczne. NT, Warszawa

2. Burden R. L., Faires J. D., 1981, Numerical Analysis. PWS-KENT, Boston 1981

Additional

1. Uściłowska A., 2009, Ćwiczenia laboratoryjne z metod numerycznych. Wydawnictwo Państwowej Wyższej Szkoły Zawodowej w Pile, Piła.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	25	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	25	1,0

[1] delete or add other activities as appropriate