POZNAN UNIVERSITY OF TECHNOLOGY
EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)
pl. M. Skłodowskiej-Curie 5, 60-965 Poznań

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Applied Mathematics for Engineers

Course

Field of study Mechatronics	Year/Semester 1/1
Area of study (specialization) -	Profile of study general academic
Level of study Second-cycle studies	Course offered in Polish
Form of study full-time	Requirements compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
0	0	0
Tutorials	Projects/seminars	
15	0	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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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 engineering applications of mathematics, in particular differential equations, discrete equations, determination of eigenvalues of matrix,

eigenvectors and modal matrices and solving non-linear ordinary and partial differential equations. This knowledge enables mathematical modelling of mechanical, electric and controlling components of mechatronic devices and description of discrete digital systems, impulse and non-linear systems and discrete algorithms [K_W01].

Skills

1. Student knows how to retrieve information from literature, databases and other properly selected sources (mostly in English) in the area of mechatronics; knows how to integrate the retrieved information, how to interpret it and how to draw conclusions and formulate and fully justify opinions [K_U01].

2. Student Knows how to apply mathematics in basic analysis of discrete and non-linear systems. He/she knows how to find solutions to basic differential, non-linear ordinary, partial and discrete equations. He/she knows how to apply mathematics in modelling properties of elements of mechatronic devices. He/she knows how to prepare a mathematical description of dynamics of components of mechatronic devices [K_U07].

3. Student knows how to define directions of further self-study and implement the process of self-education [K_U05].

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_K05].

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